

Los Angeles County Flood Control District

FLOOD OF
MARCH 2, 1938

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May 20, 1938

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Los Angeles County Flood Control District

REPORT ON FLOOD OF MARCH 2, 1938

May, 1938

INTRODUCTION

On March 2, 1938, Los Angeles County experienced a major flood which equalled or exceeded any previous flood of record. A preliminary survey made shortly after showed a toll of known dead of 113 persons and an estimated damage amounting to forty-five million dollars.

Because future planning must be based in large part upon past records, and because the Los Angeles County Flood Control District is specifically organized for the business of planning Flood Control and protection works, the present report is compiled. It presents factual data on rainfall, runoff and debris movement as far as these data are available at the present time, and makes comparisons with past and anticipated storms and floods. It is essentially a compilation and preservation of records, rather than a solution to the problems arising. Only the obvious comparisons are drawn and speculation reduced to a minimum.

REPORT

MAY 1958

INTRODUCTION

On March 2, 1958, Los Angeles County Flood Control District experienced a major flood which resulted in extensive damage to property and loss of life. A preliminary survey was conducted after a fall of snow had set in, and an estimated damage amounting to \$100,000,000 was determined. Because future planning must be based on facts, it is necessary to have a record of the flood. The Flood Control District is currently organized for the purpose of planning, flood control and protection. The present report is compiled. It contains factual data on rainfall, runoff and damage. It is as far as these data are available at the present time, and makes comparison with past and anticipated future floods. It is especially a compilation and preservation of records, rather than a solution to the problems arising. Only the outline comparisons are shown and discussion referred to a minimum.

SUMMARY

Meteorological conditions previous to and during the storm were not unusual, but may be expected to occur, and have occurred, several times each year since the District has engaged in meteorological analysis and forecast. From a meteorological point of view, worse conditions are possible and could be expected to produce a storm more intense and of longer duration than that which occurred from February 27 to March 4, 1938.

The total rainfall during the storm varied according to location in the County, ranging from seven inches near the ocean at Long Beach to a maximum of thirty inches on the face of the San Gabriel mountains and decreasing to about four inches in the desert near Lancaster. As far as records are available, this storm total about equalled the rainfall during the storm of December 1922, and exceeded all other storms during known flood periods. The maximum day's rainfall exceeded previous days' maxima during flood periods by about twenty per cent. As an average, the maximum day's rainfall had a probable recurrence frequency of sixty-five years.

The rainfall intensities for time periods less than two hours were less than would be expected for a

storm of this magnitude. In general, the probable frequency of intensities varied from once a year for a five minute duration to once in sixty years for a five hour duration.

The runoff peaks for the large catchment areas equalled or exceeded any known peaks during previous floods and in some cases, approached the computed capital flood peak based on a fifty year rainfall frequency. In the smaller catchment areas, the present flood peaks have been exceeded by previous records, notably in the storm of New Year's, 1934. For these small drainage areas, the present flood peaks were only small percentages of the peaks computed for the capital flood. This is believed to be a direct result of the subnormal short time rainfall intensities experienced during the present storm.

The maximum twenty-four hour volumes of flood runoff, as obtained at the District's reservoirs, exceeded the computed capital flood volumes for the large drainage areas. For the smaller drainage areas, the recorded volumes approached or were less than the computed capital flood volumes. These runoff volumes subjected the District's dams to the most severe test of their existence. Where the twenty-four hour runoff

volume materially exceeded the capacity of the reservoir, the peak reduction was small. Where the runoff volume was of the same magnitude, or less than the reservoir capacity, substantial reductions in peak flows were generally effected by the reservoirs.

Debris production at the District's reservoirs was the greatest of record. The loss in storage capacity varied from three to eighty per cent, and averaged twelve and one-half per cent. Rates of erosion varied from 12,000 to 80,000 cubic yards per square mile and averaged 51,000 cubic yards per square mile. The debris volumes amounted to from three to thirty per cent of the maximum twenty-four hour runoff.

At the District's debris basins the rate of debris production varied from 13,000 cubic yards per square mile to over 120,000 cubic yards per square mile. In seven of the seventeen basins an unknown amount of debris passed through the basin and over the spillway. In all, roughly 700,000 cubic yards of debris were retained by the debris basins.

Even though the present storm may be considered the maximum of record, the actual areas subjected to inundation and flooding by water escaping from regular stream channels is less than was expected from a flood

of this magnitude. This may be largely attributed to the channel protection work recently accomplished, and to the peak reduction effected by regulating reservoirs.

BODY OF REPORT

METEOROLOGY

Situation Before The Storm

In the cycle of rainfall which normally affects Los Angeles and vicinity, a season of above normal rainfall is generally followed by a season of rainfall below normal. While this rule is not infallible, it has held true 19 times and failed only eight times in the past 65 years. With the previous season of 1936-37 running close to 150 per cent of normal, it was to be expected that the current season would be below normal.

This expectation was fulfilled up to February 26, at which time the rainfall at Los Angeles was 10.67 inches, or 97 per cent of a normal season of 10.95 inches to that date. On the 27th of February a storm began which lasted until the 1st of March, bringing about 4.4 inches of rain to the city. For the next twenty-two hours, until about 10:00 P.M. on March 1st, no additional rain of consequence fell. For the next twenty hours, rain of major proportions fell in the city, amounting to 5.88 inches from midnight March 1st to midnight March 2nd. The previous high record for a like period was 4.86 inches on December 31, 1933, the time of the disastrous New Year's flood in the Montrose area. The maximum

HYDROLOGY

STATIONARY WATER LEVELS

In the cycle of rainfall which normally follows
for August and vicinity, a season of above normal rain-
fall is generally followed by a season of rainfall below
normal. While this rule is not infallible, it has held
true 15 times and failed only eight times in the past 65
years. With the previous season of 1906-07 resulting
above to 150 per cent of normal, it was to be expected
that the current season would be below normal.
This expectation was fulfilled up to February
20, at which time the rainfall at Los Angeles was 12.67
inches, or 87 per cent of a normal season of 14.45 inches
to that date. On the 25th of February, a storm began
which lasted until the 1st of March, bringing about 4.4
inches of rain to the city. For the next twenty-two
hours, until about 10:00 P.M. on March 1st, no additional
rain of consequence fell. For the next twenty hours,
with no major precipitation fell to the city, according to
5.28 inches from midnight March 1st to midnight March 2nd.
The previous high record for a like period was 4.56
inches on December 31, 1903, the tide of the discussion
New Year's flood in the Monterey area. The maximum

24-hour rainfall in the present storm amounted to 6.28 inches, occurring between 9:40 P.M. on March 1st and 9:40 P.M. on March 2nd. This 24-hour maximum has been exceeded only once in the period of 42 years since an automatic record has been kept at Los Angeles. This occasion was again the New Year's storm of 1933-34, when 7.38 inches was recorded in twenty-four hours.

In general it may be said that the rain of February 27th and 28th set the runoff stage for the major rainfall occurring on March 2nd. A chart of mass curves of rainfall for typical valley and mountain stations is attached in the Appendix as Chart I. This chart shows the hourly distribution of the rainfall throughout the five days comprising the whole storm period.

Synoptic Summary of the Storm

On Sunday, February 27, 1938, the general synoptic situation was about as follows: To the south of California and Arizona was a warm front located in an east-west direction connected to a frontal system located off the Coast of California.

Another series of frontal systems ran from the Hawaiian Islands into the Gulf of Alaska, and a third group of frontal systems ran in an east-west direction between 30 and 40 degrees North latitude and to the

West of the Hawaiian Islands.

The first mentioned warm front and frontal system located off the Coast caused a general light rain over the entire county throughout Sunday and intermittently through Monday, as it moved slowly in a northeast direction into the Great Basin. The intensities and amounts on these two days were relatively small, however, they were sufficient to put the soil in a condition which would tend to increase the rate of runoff in a succeeding storm. Most of the precipitation during the above two days was in the form of rain even in the higher mountains.

During the night of February 28th to March 1st, a storm in the form of a cold front moved through the district from the northwest. This front was the last of the series of frontal systems running from the Hawaiian Islands in to the Gulf of Alaska on the chart of February 27, 1938. The previous systems on this frontal series had passed inland to the north of the district and therefore caused no precipitation here.

The air masses separated by this front were Tropical Pacific air and Polar Pacific air. Rather high intensities of precipitation occurred during this frontal passage. This was probably due to the general increase

in wind in advance of the front and also due to the sharpness of the front itself. No general rain occurred after this frontal passage until the start of the storm of March 2nd.

The storm of March 2nd had its origin over the Pacific Ocean between 30 and 40 degrees North and to the West of the Hawaiian Islands. Fresh Polar Pacific air intermingling with old Tropical Pacific caused the development of this storm. The Polar Pacific air was unusually cold since its trajectory had been from the polar regions of Siberia and Alaska. As a rule, when the lower layers of this cold polar air mass become heated by the relatively warm ocean surface, the air becomes unstable in the lower layers and instability clouds and showers result.

On the synoptic chart on the evening of March 1, 1938, three waves had developed on the front separating Polar and Tropical air masses. These waves caused the development of individual cyclones or Low Pressure areas. Two of these cyclones were located off the Coast of California and at this time it was evident that these two systems would move inland during March 2nd. Due to the previous erratic movement of the frontal system, it was not until the evening of March 1st that the

seriousness of the situation was apparent. The erratic movement is partly due to erroneous locations of the fronts which in turn was caused by insufficient ship data. Due to a strong pressure gradient, strong south-east winds preceded the front for a considerable distance. These winds in turn caused orographical rain to start during the evening of March 1st and continue throughout the night. As the first frontal system approached the Coast during the morning of March 2nd, the winds increased even more, causing moderate to heavy amounts of precipitation.

The first frontal system apparently became stalled off the Coast and combined with the second frontal system off the Coast forming a broad frontal zone. It was not until the late afternoon of March 2nd that this frontal zone moved through the district and up to that time the orographical rain continued. A barogram trace, which is a graphic record of barometric pressure plotted against time, clearly illustrated the two combined frontal systems forming one broad frontal zone.

The rain decreased rapidly in intensity after this frontal passage and only scattered showers were reported during the night of March 2nd.

On the morning of March 3rd, a weak frontal passage took place. The precipitation from this front was of generally short duration. This front was of small magnitude since it could not be located on the synoptic chart of March 3rd.

No general rains occurred after this, however, there were numerous showers and local squalls due to the unstable Polar Pacific air which was then over the district. While the rain from this series of frontal passages approached capital storm proportions, it should be stressed that the meteorological factors involved were in no way unusual and occur in almost identical fashion at least several times each rainy season.

Perhaps the only way in which this major storm was different from other similar storms was the long duration of the strong Southeast to Southwest winds in advance of the front. This factor probably accounts for the major portion of the precipitation. In most storms the period of strong Southeast to Southwest winds exists only in the immediate vicinity of the front with a rapid shift in wind following the frontal passage. The fact that the two frontal systems combined into one system off the Coast of California is perhaps one reason for the long duration of the strong winds.

This storm clearly points out the fact that in this district only two things are necessary to cause heavy rainfall, first, an air mass having a relatively high moisture content, and second, a strong Southeast to Southwest wind. With a strong Southeast to Southwest wind the mountains in this area act as lifting devices for the air and therefore act much like "fronts" in releasing the moisture stored in the atmosphere. With this point in mind it is evident that there is no reason why a situation such as existed on March 2nd could not continue for a much longer time interval and therefore cause considerably more rain than occurred then.

RAINFALL

Storm Rainfall From February 27 to March 4, 1938

Two distinct rainfall periods occurred between February 27, 1938 and March 4, 1938. The first storm began at approximately 1:00 A.M. on Sunday, February 27, and ended on Tuesday, March 1, in the morning. The second storm began on Tuesday night, March 1, at 9:00 P.M. and continued until Thursday, March 3. Some areas received rain on the 4th as indicated.

The tabulation of daily rainfall for the first storm, included in the Appendix as Table I, is shown exactly as the observers read the gages, no distinction

being made of morning readings against afternoon readings. The total amount for this storm was the important consideration.

The tabulation of daily rainfall for the second storm showed all stations as read at 5:00 P.M. for three reasons. First, the maximum rainfall intensities and consequent unregulated peak flows occurred before 5:00 P.M. on March 2, 1938, secondly, the standard time for reading District gages was 5:00 P.M., and third, a 24-hour isohyetal map for March 2 rainfall necessitated uniform periods throughout the District. Therefore, all records which were not reported at 5:00 P.M. were interpolated to 5:00 P.M. from automatic gage records, or from standard gage readings in the vicinity having 5:00 P.M. records. Standard gage readings were used at all the District rainfall stations, while intensity gage records were utilized at all the District dams, debris basins and patrol stations.

Generally speaking, the March 2nd rainfall amounted to 50 per cent of the five day storm, ranging from 3 inches on the desert to 4 inches along the ocean, 5 inches in the valley and Coastal Plain, 7 inches in the foothills, 7 to 8 inches in the Santa Monica mountains, and 11 to 15 inches in the mountain areas. Opid's Camp

received the largest rainfall on March 2nd, amounting to 15.28 inches as of the standard time of 5:00 P.M. The maximum twenty-four hour rainfall for this station was 15.96 inches.

For the entire storm Hoegge's Camp received the largest amount, namely 30.08 inches, occurring over a period of 120 hours.

An isohyetal map, Plate I, has been prepared from the data in Table I, showing the station numbers, locations and total rainfall amounts. Lines of equal storm rainfall were located on this map from the data thus plotted.

Rainfall Intensities During Storm of March 2

The following tabulation shows the maximum rainfall intensities for various time periods during March 2nd for two rainfall stations. These two stations, the United States Weather Bureau at Los Angeles and Opid's Camp in the West Fork of San Gabriel Canyon were selected because they have automatic rainfall records long enough to give some frequency data. They are also assumed to be representative of the difference between the mountain and valley rainfall.

TABLE II COMPARISON OF RAINFALL INTENSITIES - OPID'S CAMP
AND LOS ANGELES WEATHER BUREAU

Time Period	Opid's Camp(12 Yr.Record)			L.A.W.B.(38 Yr.Record)		
	Inten- sity Inches per Hour	Probable Fre- quency in Years	No. of Times Value Exceeded During Record Period	Inten- sity Inches per Hour	Probable Fre- quency in Years	No. of Times Value Exceeded During Record Period
5 Min.	4.56	3	4	2.16	1	30
10 Min.	3.72	5	4	1.74	2	20
15 Min.	3.28	10	2	1.52	2.5	18
30 Min.	2.40	12	1	1.32	5	8
1 Hr.	1.82	17	1	.90	6	4
2 Hrs.	1.52	25	1	.72	12	4
5 Hrs.	1.52	Over 100	0	.61	60	0
24 Hrs.	.66	Over 100	0	.26	Over 100	1

As may be seen by an inspection of the probable frequencies of the rainfall for the various time periods, the rainfall on March 2nd was characterized by exceptionally infrequent intensities for time periods of five hours and more, while the intensities for the shorter time periods less than an hour are of more common occurrence. It also appears that the storm was relatively more severe in the mountains than it was in the valley, since the time period intensities at Opid's Camp all show a greater probable interval between recurrences than the same time periods at Los Angeles. For instance, the 30 minute intensity at Opid's Camp has a probable frequency of once in 12 years, while the 30 minute intensity at Los Angeles

TABLE II COMPARISON OF RAINFALL INTENSITIES - OTHER DATA
AND LOS ANGELES WEATHER BUREAU

Time Period	Intens- ity	Excessed per Year	Excessed per Year	Excessed per Year	Excessed per Year
5 Min.	4.50	4	1.15	1	10
10 Min.	3.75	4	1.74	2	20
15 Min.	3.25	2	1.52	2.5	15
20 Min.	3.40	1	1.30	2	8
1 Hr.	1.82	1	.90	6	4
2 Hrs.	1.52	1	.72	12	4
3 Hrs.	1.52 Over 100	0	.61	60	0
24 Hrs.	1.66 Over 100	0	1.90 Over 100	100	1

As may be seen by an inspection of the probable
frequency of the rainfall for the various time periods,
the rainfall on March 2nd was characterized by exceptional-
ly infrequent intensities for time periods of five hours
and more, while the intensities for the shorter time
periods were less than an hour and of more common occurrence.
It also appears that the storm was relatively more severe
in the mountains than it was in the valley, since the
time period intensities at Opita's House all show a character-
istically infrequent interval between occurrences than the same time
periods at Los Angeles. For instance, the 10 minute
intensity at Opita's Camp has a probable frequency of once
in 12 years, while the 10 minute intensity at Los Angeles

has a probable frequency of once in five years. In other words, the 30 minute intensity for the March 2nd storm probably would occur more than twice as often at Los Angeles as it would at Opid's Camp. The same analysis holds for the other time periods and results in roughly the same ratios.

Comparative Maximum Recorded Rainfall Intensities

Four mountain and five valley stations, representing each type of area, were selected in making a comparison of maximum intensities occurring on March 2, 1938 against intensities occurring at these stations from the time of their installation up to March 2, 1938. The data is summarized in the Appendix as Table III.

Generally speaking, the short time intensities for the March 2nd storm were not as large as for previous storms, in both the mountain and valley areas. Specifically, two exceptions occurred, one at Clear Creek and the other at Camp Baldy. These intensities were definitely in excess of any previous values, showing unusual storm concentration for these locations.

For the longer time intervals from one hour to 24 hours, the mountain areas only showed greater values for the March 2nd storm in comparison with previous storms.

has a tendency to persist of one or two years. In other words, the 30 minute intervals for the 1934 and 1935 seasons would occur more often than at 15 minute intervals as it would at 45 minute intervals. The same analysis could be made for the other time periods and results are tabulated in the next table.

Long term intervals between installations

Four months and five valley seasons, two-
centing each type of error, were selected in making a com-
parison of maximum installation occurring on March 2, 1934
against installations occurring at these stations from the
time of their installation up to March 2, 1934. The data
is summarized in the Appendix as Table III.

Generally speaking, the longer the interval
for the March and April seasons was as long as for previous
seasons, in both the mountain and valley areas. Generally
only two exceptions occurred, one at Clear Creek and
the other at Camp Valley. These installations were 15 minute
in the case of Clear Creek valley, and the unusual occur-
rence of 30 minute intervals for the 1934 season.
For the 1935 season, the installations were one hour in
the mountain area and 15 minutes in the valley area.
For the March and April seasons in comparison with previous seasons.

Due to the fact that no five hour interval has been used in the past in obtaining maximum intensities, and the limited time available in submitting this report, no comparisons have been made for this time interval.

Since the automatic records available cover, with two exceptions, only ten years of record, the conclusions drawn above cannot be considered valid for a long period. The Los Angeles Weather Bureau with a forty year record gives a better comparison than the short time records, and it cannot be considered to represent mountain conditions.

Maximum Hourly Rainfall Amounts in Morning
and Afternoon of March 2, 1938

In analyzing the automatic rainfall records in the county, it became apparent that there were at least two periods during the day when rainfall rates were higher than for the balance of the day. Using the one hour rainfall as a criterion, there was a peak rainfall at each station before 10:30 A.M. followed by a decrease in intensity and then by an increase to another peak hour some time in the afternoon. This observation was borne out by the fact that small drainage areas generally showed a morning peak runoff as well as afternoon peaks. In accordance with this observation, two maximum hours' values

For the fact that no live group interval has
been used in the past in obtaining maximum intensities,
and the limited time available in conducting this report,
no comparisons have been made for this time interval.
Since the subject records available cover
with two exceptions, only two years of record, the com-
parison shown above cannot be considered valid for a
long period. The 1941-42 season was fairly good with a
fairly good record giving a better comparison than the
last two records, and it cannot be considered to be
a good comparison.

Maximum Daily Rainfall in Northern
and Atlantic States, 1941-42

In analyzing the maximum rainfall records in
the country, it became apparent that there were at least
two periods during the year when rainfall was high.
The first for the balance of the year. Using the one hour
rainfall as a criterion, there was a peak rainfall of
more than 1.00 inch in 1941. This was followed by a decrease in
intensity and then by an increase to another peak hour
rainfall in the afternoon. This observation was made
by the fact that small rainfall amounts generally showed
a morning peak rainfall as well as afternoon peak. In
comparison with this observation, two maximum daily values

were selected from each automatic record, one before 10:30 A.M. and one subsequent. These values are included in the Appendix as Table IV. with the station number and name, the hour's rainfall and time it occurred. In addition to the automatic rain gages, glass graduates and collector rings had been installed at District dams and patrol houses, and short time readings made on these gages gave approximations to the maximum hours for these locations.

From these data, two maps were prepared showing iso-intensity lines for the maximum hours in the morning and afternoon. These maps are included in the Appendix as Plate II and Plate III. Where intensity data were lacking, intensity lines were sketched in to conform generally to the isohyets shown on the map of total day's rainfall for March 2nd.

From a comparison of the maximum one hour rainfall for each station in the above tabulation with the District's Iso-Intensity map used in allocating Capital flood rainfall intensities, approximate frequencies were determined.

It is significant that 90 per cent of the stations thus investigated showed that the maximum hour's rainfall had a probable frequency of once in five years or oftener,

that for five per cent the probable frequency fell between 5 and 10 years and that for five per cent the probable frequency was between 10 and 25 years. No frequency thus found exceeded 25 years.

Maximum Day's Rainfall - March 2, 1938

In Table I in the Appendix is tabulated the rainfall for all available stations for the twenty-four hours ending at 5:00 P.M. on March 2nd. While this period may not show the maximum twenty-four hour rainfall during the storm, it was necessitated by the fact that standard gauge readings are made at that time of day, and that a standard period is necessitated for uniform comparison. These values have been plotted on a map attached as Plate IV, and isohyets drawn.

Previous to the storm, frequency studies had been made on the daily rainfall at all stations having records of fifteen or more years in length. These stations are tabulated in the Appendix as Table V with the daily rainfall amount for March 2nd read at the same time of day as the balance of the record. The sequence of the table is by length of record. The length of the station record in years is shown in the third column. The fourth column shows the probable frequency in years of the day's rainfall amount on March 2nd. The fifth column shows the

number of daily values in the record higher than the value observed on March 2nd, while the sixth column shows the maximum daily value recorded, exclusive of the March 2nd value.

The mean of the probable frequency values is 66 years, which may be considered a fair estimate of the average frequency of occurrence of this storm.

Capital Storm and Capital Flood as Basis for Design

Since repeated references are made in this report to the District's Capital Storm and its Capital Flood, a brief explanation is given here of these items. The District has adopted as a basis for its design work the flood resulting from a storm having a probable frequency of occurrence of once in 50 years. This flood has been termed the "Capital Flood" and the storm causing it the "Capital Storm."

The capital storm combines probable fifty year rainfall intensity values for periods of from five minutes to 24 hours into one storm. Studies on the short time rainfall intensities had been brought up to date prior to the March 2nd storm and work was proceeding on the 24 hour amounts. However, the study of daily amounts made in 1929 is the only complete picture for the whole county.

By converting the capital storm rainfall into runoff by means of a computation method devised by the District, hydrographs of flow are prepared for all streams in the county and form the basis for comprehensive design. These studies had been revised and essentially completed for the Los Angeles River, Rio Hondo and San Gabriel River previous to the present flood.

Since the operation of reservoirs is primarily a function of flood volume and secondarily a function of flood peak, the capital flood at the District's reservoirs is assumed to be a four day flood, culminating on the fourth day in the capital flood computed on the rainfall basis.

Comparison of Rainfall on March 2nd
with Daily Amounts Having a Probable
Frequency of 50 Years as Determined
In 1929

In the area bounded by the Santa Monica mountains, the Whittier Narrows, the Puente Hills and the eastern County boundary, the March 2nd rainfall generally exceeded the 50 year storm rainfall. In the vicinity of Torrance the two were equal, while in the vicinity of Vermont Avenue and Santa Monica, the current storm exceeded the 50 year value by about an inch.

In the Santa Monica mountains, the 50 year map showed a high value of ten inches, while the maximum in

the current storm was only about eight inches. At the south edge of the mountains, the present storm was about two inches higher than the 50 year storm, while at the north edge of the Santa Monica mountains, the rainfall for the two was about the same.

The San Fernando Valley is a general low rainfall area on both storms, the present storm showing a low value just under four inches while the 50 year value is just under five inches. In this area the present storm was generally less than the 50 year storm.

The La Crescenta Valley and tributary mountain slopes showed generally more rainfall in the present storm than the 50 year storm would indicate. This excess would probably average about an inch of rainfall.

The west end of the San Gabriel Valley in the vicinity of Devil's Gate Dam, received about an inch more rain in this storm than the 50 year storm would indicate, while in the east end in the vicinity of Covina, the present storm was about an inch less than the 50 year. In general, the rainfall for March 2nd for the San Gabriel Valley would run slightly higher than for the 50 year storm.

In the mountain drainage areas, Pacoima Canyon received considerably less rain than the 50 year values

would indicate. Big Tujunga Canyon received about an inch less than the 50 year value. The Arroyo Seco above Devil's Gate received about the same amount as the 50 year value. The front face of the mountains from the Arroyo Seco to and including Big Santa Anita Canyon received more rain than the 50 year value. The balance of the front range over to the east county boundary received less rainfall on March 2nd than was computed for the 50 year storm, although not to a marked degree. The area above San Gabriel Dam No. 2, which received the highest day's rainfall of any of the dams, showed a little higher day's total than was computed for the 50 year storm. The area above San Gabriel Dam No. 1 received from one to two inches less than the computed maximum day.

As a summary, it may be said that for the drainage areas of the Los Angeles River, San Gabriel River and Ballona Creek, and for the Santa Monica mountains, the rainfall for March 2 exceeded, in general, the computed 50 year maximum rainfall.

Comparison of Storm Rainfall for Known Flood Periods

In comparing the rainfall at various stations for known flood periods, nine stations were selected from those having the longest rainfall records. Four of these

stations represent valley or foothill rainfall conditions, and five are mountain stations. The periods of known floods for which some rainfall records are available include eight storms in addition to the storm of March 2nd. Table VI in the Appendix shows for each of the storms and each of the selected rainfall stations the total storm rainfall and the maximum day's rainfall as recorded by observers. While the times during the day at which the day's readings are made will vary between stations, each station is presumably consistent in its own readings.

The maximum day and the maximum storm total for each station are underscored. Six of the nine stations show the maximum day's rainfall occurring during the current storm, while two stations show the storm of December, 1921 and one shows the New Year's, 1934 storm as recording the maximum day's rainfall. No mountain stations are available for the 1884 storm and only one for the 1889 storm.

For the total storm rainfall, four of the stations show the current storm as the largest, while four show the 1921 storm as the largest. The remaining station shows the maximum storm total for the New Year's storm. Again no mountain records are available for the 1884 storm and only one for the 1889 storm.

Computing the storm rainfall values for each station in terms of the March 2nd record and obtaining the average percentage for each storm, the figures at the bottom of the tabulation are obtained. These figures seem to show that for the maximum day's rainfall, the March 2nd storm was the greatest, followed by the New Year's storm at 80 per cent and the 1921 storm at 78 per cent. For the total storm rainfall, the recent storm was the greatest, followed by the 1921 storm at 95 per cent and then by the 1914 storm at 79 per cent. The storms of 1884 and 1889 apparently show relatively low percentage values, but this may be explained by the absence of any mountain rainfall records.

RUNOFF

Peak Runoff Quantities During Storm

Peak flows for the storm all occurred on March 2nd as far as is definitely known at the present time. These peak flows were determined in various ways. The individual methods of determination are subject to different limits of error, and the following classification has been adopted to show the type of estimate and its relative accuracy:

1. Reservoir outflow and change in storage.
2. Channel Rating Curves
 - A. Based on measurements at or near the peak
 - B. Based on extrapolation
3. Free Overfall
 - A. Over weirs
 - B. Extrapolation of low flow determination
4. Cross sections
 - A. Based on good data
 - B. Based on fair or poor data
5. Guesses.

All estimates are tabulated and attached to this report as Table VII in the Appendix and are further plotted on a map, Plate V, with their identification numbers. In plotting the data an X marks the location of the estimate, the number of barbs on the arrow indicates the number classification listed above, the letter indicates the subdivision listed above, the figure below the arrow shows the estimated peak flow in second feet,

and the slant Roman figure shows the identification number corresponding to the tabulation.

Relative Accuracy of Estimates

1. It is believed that the volumetric measurement of flows into reservoirs with known storage and outflow curves is the most accurate means of determining flow rates. For this reason it is placed first in the classification. While there is still a variation in the accuracy attainable at the various dams, due to degrees of excellence of water stage recorder records, time interval between gage board readings, accuracy of outflow determinations and accuracy of capacity curves, the peaks estimated from these records are considered quite reliable.

2. It is believed that rating curves for channel sections, based on a considerable range of flows, is the next most reliable means of estimating peak flows. Where this type of estimate has been made, the channels are either permanent concrete channels or have sides and bottom which are not subject to scour. Furthermore, these stations are all equipped with water stage recorders which are correlated with visual water stage determinations during the flood. This classification is further subdivided into two classes, depending upon whether the

rating curve is well established by measurements throughout its whole range, or established only in its low flow range and must be extrapolated for a peak determination. The former class is considered the more reliable.

3. The next in order of accuracy for peak determination is listed as free overfall. By this is meant flow over a weir, either natural or artificial, or flow over a point of sudden slope change in a channel. This classification has been subdivided into two classes, as flow over weirs and flow over sharp changes of channel grade rated at low flows. In the first type are included debris basins spillways and channel drops, while in the second are included natural falls and rock ledges in stream channels. The reason for not including debris basins in classification 1 is that during the peak flows, an unknown debris slope was present in the basin giving rise to unknown approach velocities to the weir. Most of the estimates made under the B division were extrapolations of low flow measurements obtained after the flood. The cross-sections at the "controls" were obtained at the same time, and the extension made by the application of a particular type of analysis employing a sub-tangent determination.

4. Numerous cross-sections were taken of flood channels following the storm, by numerous persons. In

classifying these estimates as based on good data, fair data, or poor data, unless personal knowledge of the data is available to the classifier, no division is made. With so many variables entering into the peak determination made from cross-sections, among which are -- reliability of cross-section taken after flood as indicating effective cross-section during flood, reliability of high water marks as indicating effective water slope, roughness factor for the channel -- this type of estimate is taken as having the most possibility of error. Where the data is unquestionably good, the bottom being known, the channel reach straight and uniform with well determined high water marks, having float velocities through the section for relatively high stages or having measurements at lower stages to establish values of Manning's "n", the estimate is given an A rating. The dividing line between the A and B rating is highly uncertain, and is solely dependent upon the judgment of the person making the rating. Where any doubt exists in that person's mind, or where no information is available on the quality of the data, the rating will be put in the lower bracket and apologies are hereby extended to the makers of the estimates who may thereby be done an injustice.

5. All estimates which cannot be classified under one of the above headings will be classed as "Guesses."

Such estimates will generally consist of peak estimates made in the field at the time of the flood by the field hydrographers or other qualified men, mainly from estimated data. While such estimates may have a high degree of accuracy, dependent upon the experience and judgment of the man making the estimate, there is normally no substantiating data by which they may be checked.

In addition to estimates made in the field, this classification will include rating curve extensions made on shifting controls with very few, if any, depth determinations.

Attention is called to the peak flows computed for Rubio Canyon at Rubio Falls, number 69, and Pasadena Glen, number 75. The peak flows as shown are upper limit figures, and would hold true for clear water peaks. The reduction in velocity and net cross-sectional area due to an unknown amount of included debris would act to decrease the figures shown. Rainfall intensities are too low to account for these flows unless considerable bulking by debris were present.

Comparison of Flood Peaks for March 2, 1938 with Previous Peaks

Following a flood the first important question raised is as to the magnitude of the flood, and second,

as to the relative magnitude as compared to previous historic storms. In the tabulations attached, Table VIII and Table IX in the Appendix, a brief comparison is made between the peak flows during the March 2, 1938 flood and the previous floods of record. On the major streams, estimates are available as far back as 1884, and where these previous estimates are listed, the source of the information is indicated by a figure in parenthesis. In general, the early flood peaks were determined at points other than those selected for current peak determination, so interpolation must be resorted to in order to obtain a direct peak comparison. Where possible, drainage area figures have been shown to assist in the interpolation. At some points, definite area figures are not possible, due to a split of tributary flow above. This is true of the Los Angeles River at Vineland, due to a split of the Tujunga below San Fernando Boulevard, and of the Los Angeles River below Rio Hondo, due to the split of the San Gabriel below Foothill Boulevard. This splitting of the San Gabriel affects all the area figures on the Rio Hondo and all area figures on the San Gabriel below Foothill Boulevard.

In making comparisons of the figures, major changes in the watershed must be kept in mind, such as building of regulating reservoirs, improvements in surface drainage, elimination of overflow areas by channel construction and the like.

Major Stream Channels - Comparison of Floods

On the Los Angeles River, it is apparent that the recent flood materially exceeded any previous flood for which runoff records are available. It was from two to four times as large as the storm of New Year's, 1934, and about twice as big as any recorded flood previous. On the Arroyo Seco, the only comparable figures are at Devil's Gate Dam, and by coincidence the present storm and the 1914 storm show the same flood peak. On the San Gabriel River, the present flood exceeded all previous floods of record by a considerable margin, considering the regulation effected by San Gabriel Dam No. 1 and Morris Reservoir. From the report of Bell, Hawgood and Conkling of September, 1925, the floods of 1884 and 1914 on the San Gabriel at the Forks were approximately equal and were exceeded by the present flood. Although there is a wide discrepancy in estimates of the 1914 flood, the average of the estimates is considerably short of the present flood figures.

Data on the Rio Hondo is not conclusive, due to the indeterminate split of flood waters of the San Gabriel River and is further complicated by the regulation effected by dams in tributary drainage area. However, the present flood is as big or bigger than any previous flood of record

with the possible exception of 1914 as determined at Whittier Boulevard.

Minor Stream Channels - Comparison of Floods

For the minor stream channels it can be said in general that the present storm produced the maximum runoff from the mountainous tributary areas, but that it has been equalled or exceeded for the streams originating on the valley floors.

Runoff Coefficient for Peak Flows

The only extended analysis of runoff values included in this report covers the areas above District's reservoirs. The data in Table X in the Appendix, shows the peak flows at the reservoirs, the drainage areas, the peak flow per square mile, the average maximum hours' rainfall in the afternoon of March 2nd over the individual drainage areas, and the runoff coefficient. The runoff coefficients are obtained by dividing the peak runoff per acre by the rate of rainfall in inches per hour, since a rate of rainfall of one inch per hour is approximately equal to a runoff of one second foot per acre with a unity runoff coefficient.

The data for San Gabriel Dam No. 1, Puddingstone Diversion Dam and Puddingstone Dam includes the effect of

reservoirs located above these points. Since there was some peak regulation and peak delay at the upper reservoirs, the flow figures and coefficients at the lower reservoirs are not necessarily comparable with the figures for the balance of the reservoirs.

The data shown in Table X for the computed Capital Flood is that portion now available from a compilation in progress at the time of the recent flood. The "Time of Concentration" is taken as the travel time of water from the most remote part of the drainage area to the concentration point, as determined from the detailed computations of the Capital Flood. It will be noted that this theoretical time of concentration varies considerably from the hour arbitrarily selected for the present storm. The "Rainfall Intensity for the Concentration Time" is the weighted average intensity over the drainage area for the concentration time, utilizing familiar Intensity-Duration rainfall curves. Since the drainage areas are subjected to zones of different intensities, the average is obtained by an area weight. The runoff coefficient is obtained in a manner similar to that used for the storm of March 2nd.

Comparison of Peak Flows of March 2
with Capital Flood Peaks at District Dams

A further comparison is made below between the peak flows experienced at the District dams on March 2nd and the peak flows computed for the Capital Flood:

TABLE XI

Comparison of Peak Flows on March 2, 1938 with
Computed Capital Flood Peaks at Flood Control Reservoirs

Dam	Peak Flow on March 2, 1938	Computed Capital Flood Peak	March 2 Peak as Percentage of Computed Capital Flood Peak
San Gabriel Dam No.1 ^o	94,380	118,200	80%
Big Tujunga	34,000	49,200	69
San Gabriel Dam No.2	23,800	13,000	183
Puddingstone ^o	5,850	18,830	31
Devil's Gate	11,400	27,100	42
Pacoima	8,150	12,550	65
Puddingstone Diver. ^o	5,550	9,220	60
San Dimas	4,400	15,000	29
Santa Anita	4,600	14,100	33
Eaton	2,225	9,400	24
Big Dalton	1,300	6,230	21
Thompson	600	5,450	11
Sawpit	1,120	5,160	22
Sierra Madre	700	2,980	24
Live Oak	355	3,070	12

^oFlows subject to regulation by reservoirs above.

In this tabulation the dams are listed in order of size of drainage area, which in general means in order of length of time of concentration. In general, the larger areas showed a closer approach to capital flood

peaks than the small areas. Similarly the March 2nd rainfall intensities for longer times (over one hour) showed a closer approach to computed capital rainfall intensities than the shorter times of less than one hour. On the basis of observed rainfall intensities, the general distribution of percentages in the above table is to be expected.

Volume of Runoff Resulting from Storm of March 2nd

At the present time, volume computations on runoff are available at the flood control reservoirs only. The data in Table XII in the Appendix shows the volumes and correlation with the rainfall on March 2nd.

Comparison of Maximum 24-Hour Runoff for March 2nd and Capital Flood

A comparison is shown below between the maximum 24-hour runoff during the storm of March 2nd and the maximum 24-hour runoff computed for the capital flood.

... and the small amount of ...
... (over the ...)
... applied to ...
... of ...
On the basis of ...
... of ...
...

Value of ...

At the present time, ...
... available at the ...
The only in Table XII in the ...
... with the ...

... of ...

A comparison is shown below between the ...
... during the ...
... applied ...

TABLE XIII

Comparison of Maximum 24-Hour Runoff During Storm
of March 2, 1938 with Computed Capital Flood

Dam	Maximum 24 Hr. Runoff		Storm of March 2nd as % of Capital Flood
	Storm of March 2	Computed Capital Flood	
San Gabriel Dam No. 1	76,730	64,100	120
Big Tujunga	24,872	13,980	178
San Gabriel Dam No. 2	16,012	9,470	170
Puddingstone ^o	5,318		
Devil's Gate	7,420	14,100	53
Pacoima	6,124	7,210	85
Puddingstone Diversion ^o	4,110	5,920	69
San Dimas	3,395	5,920	57
Santa Anita	3,404	3,520	97
Eaton	1,587	2,460	65
Big Dalton	886	1,770	50
Thompson	574	1,176	49
Sawpit	821	1,008	82
Sierra Madre	534	525	102
Live Oak	306	628	49
Average for all Dams	10,140	9,414	= 108%

^oData includes values for controlled tributary areas.

DAM OPERATION

Operation of Dams During Flood of March 2, 1938

The flood of March 2, 1938 gave the Flood Control District's dams the most severe test since their construction. Detailed operation graphs showing the operation of each dam during this storm will be found on Plates VI to XX in the Appendix. These graphs show the inflow, outflow and storage plotted against time from 8:00 A.M. on February 27, 1938 to 8:00 A.M. on March 5, 1938.

TABLE XII

Comparison of Mexican 24-hour Flood Control
at March 2, 1935 with Controlled Flood

Station	Controlled Flood	Actual Flood	Ratio of Actual to Controlled
San Gabriel Dam No. 1	76,730	64,100	1.20
San Gabriel Dam No. 2	64,475	13,900	1.78
San Gabriel Dam No. 3	10,010	9,470	1.06
San Gabriel Dam No. 4	2,310		
San Gabriel Dam No. 5	7,470	14,100	.53
San Gabriel Dam No. 6	2,110	7,610	.28
San Gabriel Dam No. 7	4,110	2,900	.43
San Gabriel Dam No. 8	2,700	2,900	.93
San Gabriel Dam No. 9	2,400	2,400	1.00
San Gabriel Dam No. 10	1,800	2,400	.75
San Gabriel Dam No. 11	1,800	1,770	1.02
San Gabriel Dam No. 12	1,800	1,770	1.02
San Gabriel Dam No. 13	1,800	1,770	1.02
San Gabriel Dam No. 14	1,800	1,770	1.02
San Gabriel Dam No. 15	1,800	1,770	1.02
San Gabriel Dam No. 16	1,800	1,770	1.02
San Gabriel Dam No. 17	1,800	1,770	1.02
San Gabriel Dam No. 18	1,800	1,770	1.02
San Gabriel Dam No. 19	1,800	1,770	1.02
San Gabriel Dam No. 20	1,800	1,770	1.02
San Gabriel Dam No. 21	1,800	1,770	1.02
San Gabriel Dam No. 22	1,800	1,770	1.02
San Gabriel Dam No. 23	1,800	1,770	1.02
San Gabriel Dam No. 24	1,800	1,770	1.02
San Gabriel Dam No. 25	1,800	1,770	1.02
San Gabriel Dam No. 26	1,800	1,770	1.02
San Gabriel Dam No. 27	1,800	1,770	1.02
San Gabriel Dam No. 28	1,800	1,770	1.02
San Gabriel Dam No. 29	1,800	1,770	1.02
San Gabriel Dam No. 30	1,800	1,770	1.02
San Gabriel Dam No. 31	1,800	1,770	1.02
San Gabriel Dam No. 32	1,800	1,770	1.02
San Gabriel Dam No. 33	1,800	1,770	1.02
San Gabriel Dam No. 34	1,800	1,770	1.02
San Gabriel Dam No. 35	1,800	1,770	1.02
San Gabriel Dam No. 36	1,800	1,770	1.02
San Gabriel Dam No. 37	1,800	1,770	1.02
San Gabriel Dam No. 38	1,800	1,770	1.02
San Gabriel Dam No. 39	1,800	1,770	1.02
San Gabriel Dam No. 40	1,800	1,770	1.02
San Gabriel Dam No. 41	1,800	1,770	1.02
San Gabriel Dam No. 42	1,800	1,770	1.02
San Gabriel Dam No. 43	1,800	1,770	1.02
San Gabriel Dam No. 44	1,800	1,770	1.02
San Gabriel Dam No. 45	1,800	1,770	1.02
San Gabriel Dam No. 46	1,800	1,770	1.02
San Gabriel Dam No. 47	1,800	1,770	1.02
San Gabriel Dam No. 48	1,800	1,770	1.02
San Gabriel Dam No. 49	1,800	1,770	1.02
San Gabriel Dam No. 50	1,800	1,770	1.02
San Gabriel Dam No. 51	1,800	1,770	1.02
San Gabriel Dam No. 52	1,800	1,770	1.02
San Gabriel Dam No. 53	1,800	1,770	1.02
San Gabriel Dam No. 54	1,800	1,770	1.02
San Gabriel Dam No. 55	1,800	1,770	1.02
San Gabriel Dam No. 56	1,800	1,770	1.02
San Gabriel Dam No. 57	1,800	1,770	1.02
San Gabriel Dam No. 58	1,800	1,770	1.02
San Gabriel Dam No. 59	1,800	1,770	1.02
San Gabriel Dam No. 60	1,800	1,770	1.02
San Gabriel Dam No. 61	1,800	1,770	1.02
San Gabriel Dam No. 62	1,800	1,770	1.02
San Gabriel Dam No. 63	1,800	1,770	1.02
San Gabriel Dam No. 64	1,800	1,770	1.02
San Gabriel Dam No. 65	1,800	1,770	1.02
San Gabriel Dam No. 66	1,800	1,770	1.02
San Gabriel Dam No. 67	1,800	1,770	1.02
San Gabriel Dam No. 68	1,800	1,770	1.02
San Gabriel Dam No. 69	1,800	1,770	1.02
San Gabriel Dam No. 70	1,800	1,770	1.02
San Gabriel Dam No. 71	1,800	1,770	1.02
San Gabriel Dam No. 72	1,800	1,770	1.02
San Gabriel Dam No. 73	1,800	1,770	1.02
San Gabriel Dam No. 74	1,800	1,770	1.02
San Gabriel Dam No. 75	1,800	1,770	1.02
San Gabriel Dam No. 76	1,800	1,770	1.02
San Gabriel Dam No. 77	1,800	1,770	1.02
San Gabriel Dam No. 78	1,800	1,770	1.02
San Gabriel Dam No. 79	1,800	1,770	1.02
San Gabriel Dam No. 80	1,800	1,770	1.02
San Gabriel Dam No. 81	1,800	1,770	1.02
San Gabriel Dam No. 82	1,800	1,770	1.02
San Gabriel Dam No. 83	1,800	1,770	1.02
San Gabriel Dam No. 84	1,800	1,770	1.02
San Gabriel Dam No. 85	1,800	1,770	1.02
San Gabriel Dam No. 86	1,800	1,770	1.02
San Gabriel Dam No. 87	1,800	1,770	1.02
San Gabriel Dam No. 88	1,800	1,770	1.02
San Gabriel Dam No. 89	1,800	1,770	1.02
San Gabriel Dam No. 90	1,800	1,770	1.02
San Gabriel Dam No. 91	1,800	1,770	1.02
San Gabriel Dam No. 92	1,800	1,770	1.02
San Gabriel Dam No. 93	1,800	1,770	1.02
San Gabriel Dam No. 94	1,800	1,770	1.02
San Gabriel Dam No. 95	1,800	1,770	1.02
San Gabriel Dam No. 96	1,800	1,770	1.02
San Gabriel Dam No. 97	1,800	1,770	1.02
San Gabriel Dam No. 98	1,800	1,770	1.02
San Gabriel Dam No. 99	1,800	1,770	1.02
San Gabriel Dam No. 100	1,800	1,770	1.02

Average for all dams 10.140 ÷ 9.414 = 1.067
 Ratio includes values for controlled flood only.

TABLE XIII

Comparison of San Gabriel Flood of March 2, 1935

The flood of March 2, 1935 gave the flood control
 classification the most severe test since their construction.
 Detailed operation graphs showing the operation of
 each dam during this storm will be found on Plate VI to
 XX in the Appendix. These graphs show the inflow, outflow
 and storage plotted against time from 0:00 A.M. on
 February 27, 1935 to 0:00 A.M. on March 2, 1935.

Table XIV in the Appendix gives a summary of the dam operation during the 24 hour period of maximum inflow, together with pertinent data.

Column No. 1 of the table shows the total storage in acre feet available at the spillway lip of each dam prior to the storm. (Data on reservoir siltation during the storm is shown in Table XV of this report).

Column No. 2 shows the per cent of available storage remaining in the reservoir at the commencement of the 24 hour period of maximum inflow.

Column No. 3 shows the maximum inflow volume in acre feet that occurred during a 24 hour period.

Column No. 4 shows the relationship of the maximum 24 hour inflow volume to the capacity of the reservoir at the spillway lip in terms of reservoir capacity.

Column No. 5 shows the total inflow volume for the three days preceding the maximum 24 hour period.

Column No. 6 shows the relationship of the three day inflow volume to the reservoir capacity in terms of reservoir capacity.

Columns Nos. 7, 8 and 9 show the peak inflow, peak outflow, and the peak reduction effected, respectively.

Column No. 10 shows the delay between the peak outflow and the peak inflow. Such a delay is particularly

effective flood control for it detains the mountain runoff and gives the valley runoff more time to dissipate leaving more channel capacity for the mountain runoff.

In studying the table, it should be kept in mind that Sierra Madre Dam is a debris retarding reservoir and that Puddingstone Diversion Dam is used for diversion of flow. As noted in the table, the peak outflow from the Diversion Dam was 5490 second feet; of this amount, 3720 second feet, or 68 per cent, was diverted to Puddingstone Dam.

The magnitude of the inflow volumes is clearly shown by the 24 hour volumes which exceeded the total capacity at all the reservoirs except three and in two instances they exceeded three times the capacity of the reservoir. The difficulty of operating the dams for material peak reduction can be clearly seen when the inflow volumes for the three days preceding the maximum 24 hour period are compared to the reservoir capacities together with the maximum 24 hour volumes.

The most extreme condition was at Big Tujunga Dam where the 24 hour volume was almost four times the capacity of the reservoir and a peak reduction of less than 5 per cent was effected.

Plate XXII in the Appendix shows an operation study at Big Tujunga Dam made on the assumption that the outlet ports were fully open during the entire storm whenever the storage exceeded 1000 acre feet. This study shows that the additional peak reduction would have been immaterial and that the inflow volume was obviously far in excess of that which could be successfully controlled with the available storage and outlet capacity.

A similar condition to that at Tujunga Dam existed at Santa Anita Dam where the maximum 24 hour inflow volume was three and one-third times the capacity of the reservoir and only a 2 per cent peak reduction was affected. The outlet ports became clogged with debris between 6 and 8 hours after the beginning of the maximum 24 hour inflow period and limited the operation to uncontrolled flow over the spillway.

Operation of Dam Outlets

The clogging of outlet ports during the storm took place at several dams as follows:

Dam	No. Outlets Available Before Storm	No. of available outlets complete- ly clogged or under silt level after storm	Silt Elevation at Dam	
			Before Storm	After Storm
Pacoima	1 at El. 1750 1 at El. 1800	1 at El. 1750	1723±	1765±
Tujunga	2 at El. 2160 1 at El. 2185	2 at El. 2160	2130±	2165±
Santa Anita	1 at El. 1177 1 at El. 1198	1 at El. 1177 1 at El. 1198	1160±	1215±
Sawpit	1 at El. 1275	1 at El. 1275	1265±	1275±
San Gabriel Dam No. 2	1 at El. 2169 1 at El. 2178 1 at El. 2247 1 at El. 2285 1 at El. 2318	1 at El. 2169 1 at El. 2178	2165±	2222±
Puddingstone Diversion	1 at El. 1139	1 at El. 1139	1130±	1139±

The clogging of the outlet at Pacoima Dam began at 2:30 A.M. on March 3rd and became completely clogged at 6:00 A.M. on March 3rd while the valve was fully open. This had no effect on the peak outflow which had occurred previous to the clogging of the outlet.

The outlets at Tujunga Dam were closed during the peak of the flood and the peak outflow took place over the spillway. Since the storm, one outlet at Elevation 2160 has been used and is in good condition. However, soundings show the silt elevation is now above the two

operative outlets a short distance from the dam.

Both outlets at Santa Anita Dam became clogged while operating fully open. Subsequent investigation showed that the fish screens have collapsed at the intakes and will probably cause difficulty in clearing the outlets. The present debris level is 17⁺ feet above the upper outlet.

The outlet at Sawpit began clogging at 10:30 P.M. and was completely clogged at midnight on March 2nd, while the valve was fully open. This did not affect the operation during the storm as the peak outflow occurred six hours previously.

Two operative outlets and one outlet that was inoperative prior to the storm at San Gabriel Dam No. 2 are under the present silt level at Elev. 2222⁺. No attempt was made, during the storm or since, to open the two operative gates. Three operative outlets, well above the present silt level, are still available for operation.

The outlet from Puddingstone Diversion Dam to San Dinis Wash was not opened until several days after the storm. This outlet was partially clogged by debris but was successfully cleared shortly after it was opened.

DEBRIS MEASUREMENTS

Summary of Debris Movement

The flood of February 28 - March 3, 1938 moved the greatest total volume of debris of any storm in the years since records of debris flow have been kept by the Flood Control District.

Of the District's 16 flood control reservoirs only one, Puddingstone, which received the major portion of its inflow de-silted, came through the flood with storage capacity unimpaired. The remaining 15 averaged a loss of 12.4 per cent in storage capacity. Several reservoirs lost over half their storage capacity, while the minimum loss was 3 per cent. Over 12,700 acre feet of debris was deposited in the reservoirs below spillway elevation.

The largest volume of debris impounded in any of the District's reservoirs from this storm was that in San Gabriel No. 1 Reservoir where approximately 5200 acre feet came in during the flood. The smallest volume was in Sunset Canyon reservoir where the loss in capacity amounted to 3 acre feet.

In the District's 16 debris basins located in general, below recently burned-over areas, a total of

689,000 cubic yards of debris was impounded. Rates of erosion of over 100,000 cubic yards per square mile of drainage area were caused by this flood which exceeded any rate previously measured in the District's debris basins.

Following the New Year's, 1934 flood, it was estimated that a total of 659,000 cubic yards of debris was deposited by the flood flows in the Tujunga - La Crescenta - Montrose - La Canada area. In the nine debris basins controlling a major part of the contributing watershed, a total of 541,000 cubic yards of debris was impounded during the recent flood which otherwise would have been deposited in the residential section of these communities duplicating the disaster of the previous flood.

The average rate of erosion for the 10.01 square miles of watersheds above the debris basins amounted to 60,000 cubic yards per square mile of watershed, exclusive of the Verdugo watershed, while the average rate from the watersheds above the reservoirs was estimated to be 51,000 cubic yards per square mile. Both of these rates include estimated volumes of debris deposited by the flood in the channels a relatively short distance above the debris basins and reservoirs, in no case exceeding one-half mile

of channel deposition.

Assuming that the total debris moved by the storm from each watershed occurred during the 24 hours of maximum inflow a wide variation in volume of debris to volume of flow occurred. The flow into Eaton Wash reservoir had the highest debris content, 30 per cent, while the lowest debris content was that in the flow coming into Puddingstone Diversion reservoir, the latter reservoir receiving most of its inflow from the de-silted outflow from San Dimas reservoir.

The lowest rate of erosion for watersheds above reservoirs, 27,000 cubic yards per square mile, was from the area above Sierra Madre Dam. This watershed represents maximum vegetative cover with a minimum disturbance by man-made works.

The rate of siltation from the inflow into Puddingstone Diversion reservoir, 77,000 cubic yards per square mile, is an example of the effect of channel scouring on rates of erosion. Because of the erosive action of the de-silted release from San Dimas Dam, a large part of the debris deposited in this reservoir originated in the two miles of channel between Puddingstone Diversion and San Dimas Dams.

An inspection of the upstream end of the reservoirs following the flood showed marked differences in conditions. Big Tujunga, Santa Anita and San Dimas reservoirs had a debris deposition tailing out for a considerable distance upstream from the high water line of the reservoir. Pacoima reservoir, on the contrary, had little deposition above spillway elevation, and considerable scouring had taken place upstream. Devil's Gate and Eaton Wash reservoirs had the highest estimated deposition of debris above spillway elevation, with the exception of San Gabriel No. 1 reservoir. The reservoirs in the eastern part of the District showed a relatively small amount of debris deposited in either reservoir or upstream channel.

In all cases low water flows are gradually moving the finer materials deposited in the reservoirs and channels above spillway elevation on down into the reservoir, so that an estimated additional 1774 acre feet of debris will further deplete the present storage capacity.

Siltation of Reservoirs

Table XV in the Appendix gives data on siltation of reservoirs from date of last survey to April, 1938.

Through the courtesy of several cooperating organizations, the majority of the reservoir surveys are of recent date and, therefore, form an excellent base for siltation determinations. Dates of the last survey on each of the reservoirs are listed in the table so that the time element in loss of storage will be indicated. It is believed, where the last survey dates back several years, that the largest part of the loss in capacity occurred during the recent flood, with the possible exception of Big Tujunga reservoir, where there has been a lapse of ten years during which debris may have moved in.

Capacities of the various reservoirs following the flood were obtained from profile and cross-section surveys of the bottoms of the reservoirs. Changes in topographical maps were then made from these surveys and the decrease in volume computed therefrom. It should be emphasized that the data on volumes of debris obtained from such preliminary surveys are of necessity approximations only, to be verified by more accurate surveys later.

Table XVI in the Appendix gives data on siltation of reservoirs since construction of dams was completed.

Table XVII in the Appendix gives data on the estimated total debris movement from date of last survey

to April, 1938.

The following comments are given in explanation of the derivation of this table:

The acre feet deposited in the various reservoirs below spillway elevation is taken from Table XV.

The estimated acre feet deposited in reservoir and channel above spillway elevation for each of the reservoirs was made by combining two volumes of debris, namely, the volume of debris between reservoir spillway and high water line obtained from the recent surveys, and the debris in the channel above each of the reservoirs which by field investigation was either moving slowly downstream or would move readily when the next streamflow occurred.

The debris movement per square mile of watershed area was calculated on the assumption that the total acre feet of debris moved occurred between February 28 and March 2, 1938. This, therefore, is more a comparative figure than an actual rate. The same can be said of the percentages of volume of debris in maximum inflow for 24 hours, where the total debris moved was assumed to occur during this period.

Data on normal annual loss in storage in District reservoirs is rather meager, due to lack of periodic surveys

of reservoir capacity. However, data on two reservoirs, Sierra Madre and Devil's Gate, are available and indicate ranges in rates of normal siltation. Sierra Madre reservoir between 1928 and 1932 had an average yearly loss in storage capacity of .22 acre feet, or 355 cubic yards per square mile of watershed area, while that in Devil's Gate reservoir between the years 1920 and 1934, amounted to 1.19 acre feet, or 1920 cubic yards per square mile of watershed area per year. Included in the average siltation rate for Devil's Gate reservoir is an accelerated rate of erosion caused by the construction of a portion of Angeles Crest Highway in the Arroyo Seco several years prior to 1934.

Deposition in Debris Basins

The following comments are given relative to the data on debris deposition in the District's debris basins as compiled in Table XVIII in the Appendix.

The designed debris capacity quantities given in this table were based upon the assumption that the maximum debris capacity of each basin would be that which would be deposited below a uniform grade line between the spillway sill and the floor at the top of the inlet structure; or on a somewhat flatter slope back from the

spillway sill if the former slope was considered to be too steep a debris gradient. At Pickens, Hall-Beckley and Las Flores Debris Basins the design debris capacity was exceeded because the debris deposited on a steeper gradient than that which had been assumed for these basins.

The final debris gradient at Pickens Debris Basin is typical of the filling of the basins from heavy debris flows. For the first 160 feet back from the spillway lip the debris was deposited on a 2 per cent slope. There was an abrupt change of gradient at this point to a 7 per cent slope so that at the top of the inlet structure the debris was 12 feet deep. The normal channel gradient above the inlet structure is approximately 7 per cent so that a progressive lifting of the channel floor took place as the debris was deposited in the basin and channel above. The maximum deposition which could have occurred would have been on a uniform 7 per cent slope back from spillway. Hall-Beckley Debris Basin approximated this maximum condition where the debris was deposited on a 5 per cent slope from the spillway lip upstream, covering the floor at the top of the inlet structure with 8 feet of debris.

The volumes of debris in the basins on March 3rd listed in the table were obtained from plane-table surveys of the debris basins following the storm.

The quantities given for Pickens and Hall-Beckley Debris Basins include a considerable volume of debris which was deposited in the channels upstream from the inlet structure. There is estimated to be approximately 40,000 cubic yards above Pickens Debris Basin and 4,000 cubic yards above Hall-Beckley Debris Basin.

At Pickens, Hall-Beckley, Dunsmuir, Verdugo, Shields, Lincoln and Las Flores Debris Basins a relatively small but unknown volume of debris passed over the spillway of these structures during the peak inflow periods, so that the total volumes eroded from the individual watersheds are in excess of the figure given.

The estimated volumes of debris in the basins prior to February 28th are based upon estimated observed quantities deposited in the various debris basins up to February 27th. In some cases the basins had been recently cleaned out, and in other cases relatively little deposition had occurred since their construction, so that the estimates given should be within a reasonable degree of accuracy.

AREAS OF INUNDATION DUE TO STORM OF MARCH 2, 1938

Immediately following the storm, the District hydrographers made a detailed reconnaissance of their individual districts for the purpose of determining the extent of flooding due to the storm. Familiarity with their streams and previous overflow areas, coupled with their observations made during the height of the flood, render the hydrographers well qualified to prepare such maps. These maps were subsequently compared with information obtained by other District employees and with airplane photos made subsequent to the flood, and additions and corrections made as warranted. The individual maps were collected and the areas actually flooded combined on one base map and attached to this report as Plate XXII in the Appendix.

The attached map, Plate XXII, is intended only as a picture of the largest areas of inundation, and cannot be used for accurate determination of areas or locations. Detailed maps to larger scale are available at the District office for such work.

NOTE - Prints of Plates VI to XX, including "Operation Records at Dams," are omitted from this copy of the report. They are available at cost of reproduction, which is \$3 for blue prints.

A P P E N D I X



**LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT**

**LOCATION OF
PEAK FLOW ESTIMATES
STORM OF MARCH 2, 1938.**

APPROVED BY *[Signature]* CHIEF ENGINEER

RECOMMENDED BY *[Signature]* DATE *4/1/38*
JR ASST CHIEF ENGR CHIEF HYDRAULIC ENGR April 1938



LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT

ISOHYETAL MAP
24 HOUR PERIOD
ENDING 5:00 P.M.
MARCH 2, 1938.

APPROVED BY _____
CHIEF ENGINEER

RECOMMENDED BY _____
DATE _____
CHIEF HYDRAULIC ENGR.



**LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT**

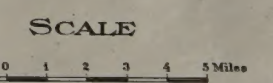
**MAXIMUM
ONE-HOUR RAINFALL
AFTERNOON OF MARCH 2, 1936.**

APPROVED BY *C. H. [Signature]*
CHIEF ENGINEER

RECOMMENDED BY *Paul B. [Signature]* DATE *April 1936*
JR. ASST. CHIEF ENGR. CHIEF HYDRAULIC ENGR.



NOTE: Dotted contours were drawn from insufficient data.



**LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT**

**MAXIMUM
ONE-HOUR RAINFALL
MORNING OF MARCH 2, 1938**

APPROVED BY	<i>C. H. Hall</i>
CHIEF ENGINEER	
RECOMMENDED BY	<i>W. B. Brown</i>
JR. ASST. CHIEF ENGR.	DATE
<i>W. B. Brown</i>	APRIL 1938



LEGEND

- Flood Control Standard Gages
- Flood Control Automatic & Standard Gages
- ◆ Flood Control Standard Gage Active - Automatic Gage Inactive
- ◆ United States Weather Bureau Standard Gage
- ◆ United States Weather Bureau Automatic Gage
- ▲ Private Gage, Standard Type
- ◆ Private Gage, Automatic Type
- ◆ Flood Control Automatic & Private or U.S. Weather Bureau Standard
- ◆ Flood Control Automatic Active - U.S. Weather Bureau Automatic Inactive
- ⊙ An Inactive Gage is Shown by Encircling the Symbol
- ⊙ at a Station Denotes a Flood Control Evaporation Tank
- Capital Letters A, B, etc. Following a Station Number Denote Successive Locations of a Gage in a Locality
- Lower Case Letters a, b, etc. Following a Station Number Denote Several Gages Operated Simultaneously by a Single Observer
- Note: Where necessary to use two symbols the Location is Designated by the "Active" symbol
- Note: Inactive Flood Control Gages have been Removed.

248 B = NUMBER OF STATION - CAPITAL LETTER DENOTES 2ND LOCATION
18.05 = SEASONAL RAINFALL IN INCHES
20 = LINES OF EQUAL RAINFALL - ESTIMATED INCHES DEPTH
30 = LINES OF EQUAL RAINFALL - ESTIMATED INCHES DEPTH
⊙ = INACTIVE STATION - NO RECORDS OR INCOMPLETE SEASON

SCALE

1 2 3 4 5 Miles

LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT

ISOHYETAL MAP
STORM OF FEBRUARY 27
TO MARCH 4, 1938.

APPROVED BY: *[Signature]* CHIEF ENGINEER
RECOMMENDED BY: *[Signature]* DATE: April 1938
ASST. CHIEF ENGR. CHIEF HYDRAULIC ENGR.

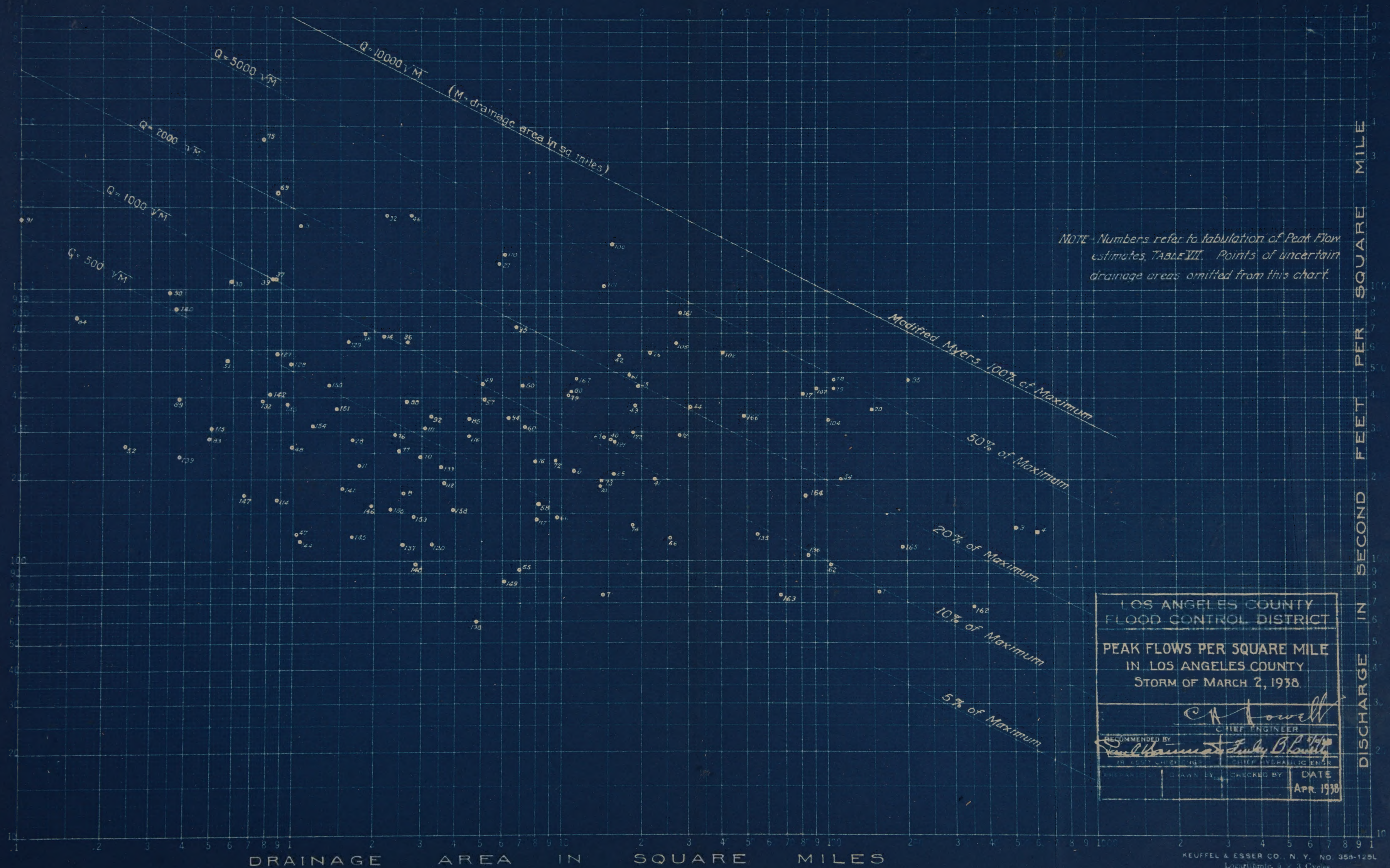


LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT

INUNDATED AREAS
FLOOD OF MARCH 2, 1938

APPROVED BY *[Signature]* CHIEF ENGINEER
RECOMMENDED BY *[Signature]* DATE *April 1938*
J. ASST. CHIEF ENGR. CHIEF HYDRAULIC ENGR.

NOTE: Flooded area data on this map is pictorial only and can not be used for accurate determination of areas or location. Detailed maps to larger scale are available at the District's office for such purposes. Flooded areas north of Los Angeles and San Gabriel River drainage areas and west of Topanga Canyon have been omitted from this map.



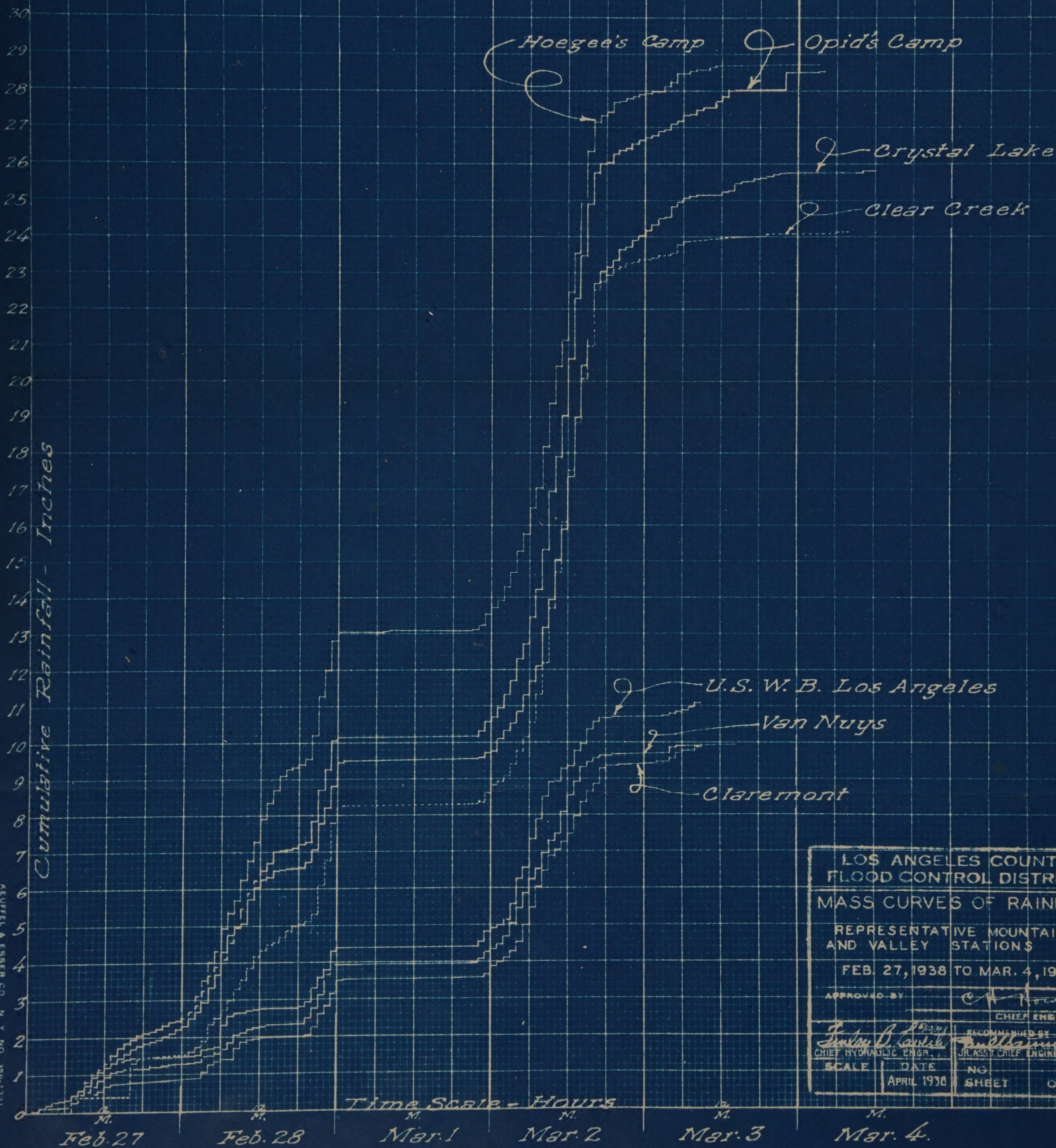
Feb. 27 Feb. 28 Mar. 1 Mar. 2 Mar. 3 Mar. 4

6 12 6 12 6 12 6 12 6 12 6 12 6 12 6 12 6 12 6 12
A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M.

Note:- Curves are based on automatic raingauge records

Note:- Opids Camp record interpolated after 2:17 P.M. Mar. 2^d from intensity gauge readings when automatic gauge reached capacity.

Note:- No automatic record at Crystal Lake between 3:40 P.M. Mar. 2^d when gauge reached capacity, and 5:00 P.M. when re-set.



LOS ANGELES COUNTY FLOOD CONTROL DISTRICT			
MASS CURVES OF RAINFALL			
REPRESENTATIVE MOUNTAIN AND VALLEY STATIONS			
FEB. 27, 1938 TO MAR. 4, 1938			
APPROVED BY		<i>C. H. Kountz</i>	
		CHIEF ENGINEER	
<i>Frank B. Smith</i>		<i>Paul J. Smith</i>	
CHIEF HYDRAULIC ENGR.		JR. ASST. CHIEF ENGINEER	
SCALE	DATE	NO.	SHEET
	APRIL 1938		OF

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

Sheet 1

Rainfall
Storm of Feb. 27, 28, March 1, 2, 3, 4, 1938

No.	Station	2-27	2-28	3-1	Total	5 PM 3-2	3-3	3-4	Total	Grand Total
2	Escondido Patrol	.49	2.00	1.85	4.34	4.58	1.33	.03	5.94	10.28
4	Crags Country Club	°	2.75	2.90	5.65	6.25	1.48		7.73	13.38
5	Calabasas	.93	.96	1.70	3.59	5.07	.46		5.53	9.12
6	Topanga Canyon	1.27	3.03	3.08	7.38	7.98	.35		8.33	15.71
7C	Bel-Air Bay Club	1.02	1.35	2.44	4.81	5.25	.28		5.53	10.34
9	Sepulveda-Chase	1.13	1.08	1.73	3.94	4.55	.33		4.88	8.82
10	Bel-Air	1.58	2.02	2.00	5.60	6.83	.21		7.04	12.64
11	Upper Franklin Res.	1.35	1.99	2.09	5.43	5.62	.45		6.07	11.50
12	Franklin-Mulholland Fire Sta. No. 1	1.50	2.43	2.38	6.31	6.65	.53		7.18	13.49
13	No. Hollywood - Blix	.32	2.26	3.05	5.63	6.32	.45	.02	6.79	12.42
14	Roscoe - Merrill	.15	1.71	1.91	3.77	4.06	.68	0	4.74	8.51
15	Van Nuys City Whse.	1.19	1.14	1.83	4.16	5.16	.37	.02	5.55	9.71
17	Sepulveda Cn. Mulholland Fire Sta. No. 2	.54	2.10	4.28	6.92	7.24	.48		7.72	14.64
18	Adohr Dairy	.24	1.87	2.52	4.63	5.41	.45	.04	5.90	10.53
19	Topanga - Summit	°	2.70	1.95	4.65	5.44	.49	.09	6.02	10.67
20	Girard	.96	1.07	1.53	3.56	5.37	.52	.05	5.94	9.50
21	Brant Ranch	.40	1.16	2.01	3.57	5.33	.52	.05	5.90	9.47
22	Johnson-Woodruff Reh. Bell Cn.	.75	1.26	1.52	3.53	5.41	.54		5.95	9.48
23E	Chatsworth Res.	.05	1.07	2.08	3.20	5.12	.66		5.78	8.98
24B	Chatsworth	°	1.52	1.58	3.10	4.68	.76		5.44	8.54
25	No. L. A. - Andrews	.12	1.31	1.75	3.18	5.43	.54		5.97	9.15
28	San Fernando-Lemon Gr. Assn.	.03	1.31	2.64	3.98	4.46	.49		4.95	8.93
29B	Granada Pump Plt.	.48	1.79	1.75	4.02	4.14	.54		4.68	8.70
30	Sylmar	°	2.32	1.43	3.75	4.35	.68		5.03	8.78
32E	Newhall	1.05	1.40	1.85	4.30	5.22	.94		6.16	10.46
33A-E	Pacoima Dam (Caretakers hse)	.88	1.94	2.01	4.83	5.38	1.27		6.65	11.48
38	Chappell Ranch	1.07	1.27	1.46	3.80	4.17	.70		4.87	8.67
39	Sunset Cn. - Burbank	1.29	2.01	2.44	5.74	6.78	.73		7.51	13.25
43b	Palos Verdes (Golf Club)	°	2.10	1.52	3.62	2.61	.49		3.10	6.72
44	Point Vicente Lt. House	.78	.39	1.27	2.44	2.59	.49		3.08	5.52

TABLE I

No.	Station	2-27	2-28	3-1	Total	5 PM 3-2	3-3	3-4	Total	Grand Total
46B-E	Big Tujunga Dam	1.29	3.19	3.00	7.48	10.83	2.05		12.88	20.36
47A	Clear Creek	1.34	3.39	3.61	8.34	12.41	1.54	.08	14.03	22.37
48	Oak Wild	1.60	3.14	1.91	6.65	11.13	1.37		12.50	19.15
49	Altadena - Chiesa	1.86	2.75	2.18	6.79	8.33	.62		8.95	15.74
50B	Arroyo Seco Patrol	1.65	2.83	3.23	7.71	8.47	1.36		9.83	17.54
51	Little Cienega (Headlee)	1.55	4.17	3.35	9.07	12.76	.44	.10	13.30	22.37
52	Switzer's Camp	1.20	2.69	2.02	5.91	12.41	1.46		13.87	19.78
53A	Sleepy Hollow Ranch	2.13	1.70	2.45	6.28	10.95	1.52	.06	12.53	18.81
53B	Colby's Ranch (Lower)	1.97	1.55	2.23	5.75	7.82	1.76		9.58	15.33
54	Loomis Ranch (Alder Cr.)	1.24	.93	1.62	3.79	7.99	1.09	.15	9.23	13.02
57BE	Opid's Camp	1.79	4.89	3.21	9.89	15.28	2.08	.02	17.38	27.27
58	Sturtevant Camp	2.00	6.07	2.98	11.05	12.12	1.96	T	14.08	25.13
60A	Hoegee's Camp	1.71	7.82	4.06	13.59	14.73	1.72	.04	16.49	30.08
62	Santa Anita Rgr. Sta.	.47	7.12	4.01	11.60	10.64	1.36		12.00	23.60
63B-E	Santa Anita Dam	1.30	4.06	2.53	7.89	6.76	.73		7.49	15.38
65	Sierra Madre - Hersey	1.54	3.68	2.18	7.40	7.89	.58		8.47	15.87
66	Sierra Madre - Pegler Rch.	1.43	3.60	2.60	7.63	7.35	.83		8.18	15.81
67B	Monrovia City Hall	.97	2.65	2.20	5.82	7.46	.69		8.15	13.97
68B	Sawpit Dam	1.05	3.81	2.81	7.67	7.89	3.95		11.84	19.51
69	Sawpit Canyon	1.03	3.64	2.85	7.52	7.96	4.00		11.96	19.48
70E	Dalton No. 1	.27	2.20	4.04	6.51	7.26	1.10	.06	8.42	14.93
73	Glendora - Englewild	2.59	1.48	2.94	7.01	8.17	.52	.13	8.82	15.83
76	San Gabriel Forks	1.36	3.67	3.07	8.10	12.19	1.55		13.74	21.84
76B	San Gabriel Dam #1(Camp)	1.48	3.72	3.10	8.30	12.19	1.50		13.69	21.99
80	Prairie Forks	°	3.35	2.21	5.56	7.49	2.53	.13	10.15	15.71
82	Table Mountain	1.80	1.40	.88	4.08	4.59	1.71	.02	6.32	10.40
83E	Big Pines Camp	2.00	2.59	1.68	6.27	8.56	2.89	.13	11.58	17.85
85D	Camp Baldy Rgr. Sta.	1.16	3.73	3.56	8.45	11.67	3.26	.60	15.53	23.98
87	San Dimas Rgr. Sta.	1.21	2.46	2.01	5.68	7.07	1.58		8.65	14.33
89E	San Dimas Dam	1.14	2.19	1.83	5.16	7.07	1.58		8.65	13.81
90	Brydon's Ranch	1.10	2.13	2.31	5.54	6.35	1.68	.05	8.08	13.62
91	Claremont - Indian Hills	.88	1.81	1.94	4.63	5.55	1.47		7.02	11.65
92	Pomona College	.79	1.25	1.63	3.67	5.19	1.13		6.32	9.99
93	Claremont - Fire Sta.	.82	1.24	1.66	3.72	5.00	1.10		6.10	9.82
94	Charter Oak - Fields	1.50	1.65	1.95	5.10	6.79	1.06		7.85	12.95

No.	Station	2-27	2-28	3-1	Total	5 PM 3-2	3-3	3-4	Total	Grand Total
95	San Dimas - Fire Warden	1.12	1.67	1.90	4.69	6.20	1.04		7.24	11.93
96E	Puddingstone Dam	1.09	1.63	1.68	4.40	5.45	1.68		7.13	11.53
97	San Dimas - Ferguson	1.10	1.84	2.01	4.95	6.63	1.11		7.74	12.69
98	Azusa - Hibsche	1.40	2.22	2.35	5.97	6.72	.91		7.63	13.60
99	Azusa - Foothill Rch.	1.42	2.40	2.48	6.30	6.61	.76		7.37	13.67
104	No. Whittier - Cole Rch.	1.62	1.23	2.00	4.85	5.06	1.15		6.21	11.06
105	E. Whittier - Sharples	1.43	.61	1.50	3.54	4.70	.62		5.32	8.86
106	Whittier - City Hall	1.28	.67	1.65	3.60	4.50	.73		5.23	8.83
107B	Downey - Fire Sta.	1.77	.67	1.52	3.96	4.16	.60	.04	4.80	8.76
108B	El Monte - Fire Sta.	°	2.65	2.08	4.73	6.00	.92		6.92	11.65
109	West Arcadia	1.32	2.23	2.38	5.93	7.57	.57		8.14	14.07
110	Alhambra	°	4.02	1.88	5.90	7.11	.59		7.70	13.60
111	So. Pasadena	1.60	2.10	2.15	5.85	6.97	.45		7.42	13.27
116	Inglewood High School	.81	1.55	1.52	3.88	3.86	.92	.04	4.82	8.70
117C	Compton	1.63	.48	1.36	3.47	3.70	.55	.04	4.29	7.76
118B	Wilmington	1.39	1.49	.15	3.03	3.67	.63		4.30	7.33
119	Soldiers Home	1.35	2.12	1.75	5.22	5.56	.54		6.10	11.32
120	Vincent Patrol Sta.	1.00	.30	.78	2.08	3.37	.48		3.85	5.93
121	Lancaster	°	.80	.45	1.25	2.85	.47		3.32	4.57
124B	Bouquet Canyon	.42	1.99	.12	2.53	4.61	.77		5.38	7.91
125	Power House No. 1	T	.95	1.64	2.59	4.74	.79	.10	5.63	8.22
126	Venice - City Hall	°	2.96	1.38	4.34	4.19	.51		4.70	9.04
127	Dry Canyon Res.	.05	.67	1.21	1.93	2.91	.53		3.44	5.37
128E	Radium Hot Springs	.44	1.79	1.79	4.02	8.30	.80		9.10	13.12
130	Sanberg	°	1.65	1.59	3.24	3.72	.61		4.33	7.57
134	San Dimas - Stevens	1.15	1.92	2.25	5.32	6.50	1.20		7.70	13.02
135	Norwalk	1.36	.52	1.58	3.46	4.22	.82	.02	5.06	8.52
136B	Hollywood	°	2.98	1.95	4.93	5.87	.41		6.28	11.21
137B	Curson Canyon	1.48	2.05	1.94	5.47	6.25	.45		6.70	12.17
139	L.A. 2nd & Hill L.A.W.D.	°	2.36	1.88	4.24	6.17	.48		6.65	10.89
	F.C. Roof 751 S. Figueroa St.	1.30	1.57	1.65	4.52	5.89	.46		6.35	10.87
140	Sawtelle - West L. A.	1.36	2.14	1.77	5.27	5.31	.52		5.83	11.10
143	Azusa - City Hall	1.33	2.25	2.30	5.88	6.72	.84	T	7.56	13.44
144	Sierra Madre Dam	.56	3.54	4.48	8.58	8.82	.68		9.50	18.08
150	Monrovia Falls	1.20	4.74	3.24	9.18	10.64	4.20		14.84	24.02
155B	Little Rock Creek	1.22	.43	.94	2.59	3.80	.45		4.25	6.84

No.	Station	2-27	2-28	3-1	Total	5 PM 3-2	3-3	3-4	Total	Grand Total
156	La Mirada	.18	1.27	1.62	3.07	3.70	.52	.02	4.24	7.31
157E	El Segundo	1.11	.65	1.23	2.99	3.20	.50		3.70	6.69
158	Tanbark Flats	1.26	3.66	3.35	8.27	10.83	1.79	.31	12.93	21.20
167	Arcadia Pump Plant	1.22	2.96	2.86	7.04	7.67	.83		8.50	15.54
168	San Gabriel - Watts	1.65	2.10	1.83	5.58	7.11	.53		7.64	13.22
169	Sierra Madre - Hogan	.40	3.07	3.55	7.02	8.31	.61		8.92	15.94
171	Chapman Wells	1.60	2.79	2.30	6.69	7.51	.57		8.08	14.77
176	Altadena - Rubio Cn.L.&W. Assn	1.61	2.84	2.50	6.95	8.20	.53		8.73	15.68
178	Azusa - Griffith	1.31	1.75	2.01	5.07	5.86	.91		6.77	11.84
179	Sierra Madre - Carter	1.63	3.98	2.36	7.97	8.61	.63		9.24	17.21
182	Baldwin Park - Leach	1.60	1.60	1.71	4.91	5.68	.87		6.55	11.46
185	Glendora - West	.98	2.45	2.61	6.04	6.70	.98		7.68	13.72
187	San Dimas - Mount	1.16	1.65	1.91	4.72	6.17	.97		7.14	11.86
192B	Bell Fire Dept.	1.65	1.31	1.85	4.81	4.60	.42		5.02	9.83
193	Covina - Temple	1.36	1.48	1.86	4.70	5.54	.86		6.40	11.10
198	Brand Estate	1.28	1.60	2.14	5.02	6.06	.42		6.48	11.50
199B	Huntington Park	1.60	1.23	1.66	4.49	4.54	.57		5.11	9.60
200	Saugus S.C.E.Co.	.58	.77	1.05	2.40	3.27	.55	.16	3.98	6.38
205	Puente - S.C.E. Co.	1.53	.91	1.64	4.08	4.83	1.10		5.93	10.01
208	Artesia - Barr Lumber Co.	°	1.72	1.55	3.27	4.40	.78		5.18	8.45
210B	Brand Park	1.33	2.08	2.54	5.95	7.02	.75	.01	7.78	13.73
213	Hancock Park	1.26	1.75	1.65	4.66	5.50	.40		5.90	10.56
216	Glendale - Jones	.49	1.85	2.45	4.79	7.06	.21		7.27	12.06
217	Watts	°	2.35	1.60	3.95	3.62	.54	.04	4.20	8.15
218	Torrance - Gen. Petrol.	1.28	.46	1.37	3.11	2.95	.55		3.50	6.61
219	San Fernando Rgr.St.Whse.	.96	1.44	1.58	3.98	4.97	.76		5.73	9.71
220	Whittier Narrows	1.16	1.13	1.73	4.02	4.75	.61		5.36	9.38
222	Lankershim Power Plt.	.50	1.52	1.92	3.94	4.05	.29		7.00	10.94
223B-E	Big Dalton Dam	1.24	3.66	3.39	8.29	7.23	1.71	.08	9.02	17.31
224	Long Beach - Los Alamitos	1.05	.52	1.39	2.96	3.70	.63		4.33	7.29
225	Montana Rch.	.24	1.44	1.65	3.33	4.77	.71	.05	5.53	8.86
226	Burbank	1.41	1.79	2.43	5.63	6.43	.71		7.14	12.77
227B	San Gabriel - Gleason	1.65	2.10	1.83	5.58	7.11	.53		7.64	13.22
228B	Beverly Hills - City Hall	1.42	2.24	1.79	5.45	6.08	.30		6.38	11.83
230C	Live Oak Canyon - Elder	.97	1.84	1.85	4.66	5.51	1.68	T	7.19	11.85

No.	Station	2-27	2-28	3-1	Total	5 PM 3-2	3-3	3-4	Total	Grand Total
234	Covina - Thorpe	.98	1.33	1.62	3.93	4.70	.73		5.43	9.36
235	Henninger Flats	1.30	4.03	3.15	8.48	9.50	1.28		10.78	19.26
236	Ford Craig Ranch	.77	1.72	1.76	4.25	4.19	.99		5.18	9.43
237	Stone Canyon Dam	°	2.78	3.31	6.09	7.01	.38		7.39	13.48
238	Hollywood Dam	°	2.39	2.10	4.49	5.65	.34		5.99	10.48
240	Little Tujunga	.83	1.42	1.62	3.87	5.04	.84	.04	5.92	9.79
241	Long Beach	.02	1.38	1.63	3.03	3.71	.64		4.35	7.38
242	La Verne - Jones	1.00	1.75	1.83	4.58	6.35	.95		7.30	11.88
244B	Bear Creek	°	°	9.94	9.94	14.02	1.83	.09	15.94	25.88
246B	Culver City	.17	1.56	2.25	3.98	5.69	.41		6.10	10.08
248E	West Saddle Peak	.81	2.79	2.65	6.25	6.47	.27		6.74	12.99
249	Mint Cn. Oak Garage	.41	.40	1.11	1.92	3.70	.80		4.50	6.42
251	La Crescenta	1.21	3.35	3.08	7.64	10.27	.89		11.16	18.80
253	Western Ave. Tank	1.30	2.50	.81	4.61	3.76	.89	.04	4.69	9.30
254	Rowlands Ranch	.25	2.00	2.05	4.30	4.84	1.10		5.94	10.24
255	State Narcotic Hospital	.17	1.74	2.02	3.93	4.81	.88		5.69	9.62
256	Pomona S.P.R.R.	.10	1.55	1.87	3.52	5.25	.96		6.21	9.73
257	Griffith Park Nursery	1.22	1.80	1.68	4.70	6.16	.33		6.49	11.19
258a	Griffith Park Tunnel	°	2.03	1.83	3.86	6.71	.36		7.07	10.93
258b	Griffith Park So. Slope	°	2.10	1.92	4.02	7.03	.37		7.40	11.42
258c	Griffith Park No. Slope	°	2.14	2.52	4.66	7.48	.56		8.04	12.70
259b	Chatsworth Co.F.S.Twin Lakes	.53	1.19	2.06	3.78	6.10	.80		6.90	10.68
261E	Acton - Mellen	.59	.26	.89	1.74	3.05	.81	.03	3.89	5.63
265BE	Puente Hills (LaHabra Hts)	1.39	1.02	1.97	4.38	5.33	.70	.02	6.05	10.43
266	E.Whittier-Leffingwell Rch	°	1.95	1.98	3.93	5.01	.81		5.82	9.75
268E	Torrance S.C.E.Co.	1.32	.45	1.23	3.00	3.05	.21		3.26	6.26
269a	Horse Camp-Dia Bar Rch.	1.01	1.48	1.71	4.20	5.35	1.15		6.50	10.70
269	Diamond Bar Rch. No. 1	.98	1.44	1.75	4.17	5.59	1.20		6.79	10.96
270	County Farm	1.58	.46	1.54	3.58	4.01	.58	.03	4.62	8.20
271	Dominguez Hills	1.71	.44	1.43	3.58	3.41	.34	.04	3.79	7.37
272	Headworks Plant Riv.Dr.	1.44	2.09	2.46	5.99	7.31	.55		7.86	13.85
274	Acton - Hubbard	.50	.26	.72	1.48	2.82	1.13	.04	3.99	5.47
277	Sawmill Mt. Rch.	.68	1.51	1.29	3.48	6.16	1.26	.12	7.54	11.02
278	Clark Memorial Lib.	1.25	1.74	1.64	4.63	5.30	.38		5.68	10.31

No.	Station	2-27	2-28	3-1	Total	5 PM 3-2	3-3	3-4	Total	Grand Total
279	Kinneloa Ranch	1.54	2.07	2.04	5.65	8.70	.78		9.48	15.13
280	Flintridge-Fire Sta.	1.46	2.71	2.35	6.52	7.77	.64		8.41	14.93
283a	Crystal Lake - East	1.72	5.05	3.31	10.08	12.62	3.14		15.76	25.84
283b	Crystal Lake - West	1.65	5.02	3.35	10.02	12.32	3.34		15.66	25.68
284	Placerita Canyon	2.10	3.30	2.25	7.65	5.10	.35		5.45	13.10
286B	Hermann Rch. S.F.Valley	.68	1.20	1.48	3.36	4.45	.65		5.10	8.46
289	Laguna Bell	1.72	.64	.74	3.10	4.55	.37		4.92	8.02
290	Newmark	1.65	1.67	1.63	4.95	5.89	.60		6.49	11.44
291	96th and Central	1.68	1.18	.74	3.60	3.42	.80		4.22	7.82
293	Lower San Fernando Res.	°	1.30	2.65	3.95	4.79	.63		5.42	9.37
294	Mira Monte Res.	.53	3.47	4.38	8.38	8.92	.66		9.58	17.96
295D	Glendale - Taylor	1.35	1.80	1.85	5.00	7.07	.21		7.28	12.28
299C	Calivalli Farms	.82	.30	1.68	1.80	1.93	.37	T	2.30	4.10
300B	Garrapata Canyon	1.20	2.70	2.75	6.65	7.70	.13		7.83	14.48
303	Cal Tech	1.62	2.72	2.27	6.61	7.53	.63		8.16	14.77
305	Mason Estate (Arroyo Sequis)	.42	1.89	2.74	5.05	5.98	.97		6.95	12.00
311	Pasadena - Sunset Res.	1.65	2.61	2.27	6.53	7.48	.60		8.08	14.61
312	Glendora Irr. Co. Azusa	1.25	2.34	2.41	6.00	7.00	.96		7.96	13.96
314	San Dimas Water Co.	1.00	1.74	2.02	4.76	6.10	1.01		7.11	11.87
317	Big Pines - Sawmill Flat	1.98	2.22	1.72	5.92	8.57	2.89	.13	11.59	17.51
318	Big Pines-Jackson Lake	2.54	2.08	2.29	6.91	9.46	3.20	.20	12.86	19.77
319	Big Pines-Apple Tree Flat	2.73	2.68	2.45	7.86	9.16	3.09	.20	12.45	20.31
320A	Sycamore Cn. Chevy Chase	1.39	2.48	2.10	5.97	6.27	.61		6.88	12.85
321E	Pine Canyon Patrol	.80	1.79	1.22	3.81	5.41	.90	.12	6.43	10.24
334E	San Gabriel Dam #2	1.90	4.53	3.52	9.95	13.42	1.18		14.60	24.55
336	Silver Lake Res.	°	2.67	2.43	5.10	6.40	.42		6.82	11.92
338	Mt. Wilson Std. Gage	2.16	5.93	3.99	12.08	12.57	1.58		14.15	26.23
339	Walnut Fruit Growers Assn.	°	2.29	1.89	4.18	5.47	1.12		6.59	10.77
341	Blum Ranch	1.17	.27	.91	2.35	5.63	.67		6.30	8.65
342	Upland	.73	1.39	1.75	3.87	5.29	1.16		6.45	10.32
343	Telegraph Road	1.50	.55	1.59	3.64	4.01	.54		4.55	8.19
348B	Honor Camp #4	.57	2.93	2.33	5.83	8.62	1.61		10.23	16.06
349	Camp Rincon	1.39	3.89	2.65	7.93	11.89	2.11	.16	14.16	22.09
351DE	Palmdale	°	1.41	.87	2.28	2.82	.47		3.29	5.57

No.	Station	2-27	2-28	3-1	Total	5 PM 3-2	3-3	3-4	Total	Grand Total
352	Lechuza Patrol Sta.	.60	2.42	2.85	5.87	5.84	1.25	.08	7.17	13.04
354B	Honor Camp #6	1.38	3.88	4.25	9.51	13.13	2.70	.50	16.33	25.84
355	L. A. Junior College	1.30	1.81	1.71	4.82	6.07	.48		6.55	11.37
356	Diamond Bar Rch.#2 Spadra	°	1.85	1.55	3.40	4.78	.87		5.65	9.05
357	Power House #3	°	1.22	3.21	4.43	5.02	.78		5.80	10.23
358B	Aldrich Ranch	1.78	.72	1.40	3.90	4.47	.69		5.16	9.06
360	Haines Cn. Gravel Pit	1.20	2.58	2.22	6.00	7.47	.75		8.22	14.22
362	El Mirador Ranch	1.51	2.46	2.17	6.14	7.72	.55		8.27	14.41
364	Lower Haines (U.S.G.S.)	1.27	2.70	2.36	6.33	7.80	.85	.02	8.67	15.00
366	Valyermo	1.00	.98	1.17	3.15	3.28	.32	.12	3.72	6.87
367	Upper Haines Canyon	1.57	3.31	2.95	7.83	10.39	1.16	.02	11.57	19.40
372	San Francisquito P.H.#2 T		.87	1.78	2.65	4.57	.76	.10	5.43	8.08
373	Briggs Terrace (Pickens)	1.18	3.36	3.15	7.69	9.98	.86		10.84	18.53
377C	Lake Sherwood Estates	1.02	.78	2.08	3.88	5.73	.46		6.19	10.07
378	La Canyada - Hall	1.55	3.20	2.65	7.40	8.99	1.09		10.08	17.48
379	San Gabriel - E. Fork	1.48	3.36	2.88	7.72	10.90	1.60	.03	12.53	20.25
380	El Sereno	1.34	1.69	1.94	4.97	6.43	.40		6.83	11.80
381B	Santa Monica "Outlook"	.30	2.63	1.50	4.43	4.56	.44		5.00	9.43
382B	Marks Pasture Puente Hills	1.65	1.35	2.25	5.25	6.55	.75		7.30	12.55
384	San Rafael Hills-Laverty	1.62	2.14	1.92	5.68	6.17	.60		6.77	12.45
385	No. Whittier Heights-Smith	1.75	1.22	1.90	4.87	6.24	1.42		7.66	12.53
386B	Dume Canyon - Oakley	.75	2.90	4.18	7.83	6.00	2.20	.03	8.23	16.06
387	Covina City Water Dept.	1.27	1.51	1.92	4.70	4.67	1.55		6.22	10.92
388	Hynes - Hayden	1.65	.42	1.42	3.49	3.54	.83	.03	4.40	7.89
389	Glendora - Brown	1.35	2.56	2.73	6.64	6.69	1.66		8.35	14.99
390	Morris Dam	1.36	3.86	3.13	8.35	8.68	1.25	.08	10.01	18.36
392	Altadena - Barton	1.51	3.50	2.65	7.66	8.33	.62		8.95	16.61
393	L. A. Casey	1.41	1.73	1.47	4.61	5.66	.38		6.04	10.65
394	Highland Park-Lindsey	1.70	2.25	2.01	5.96	6.48	.63		7.11	13.07
395	Olive View Sanatorium	°	2.54	1.84	4.38	4.92	.84		5.76	10.14
396	Oneoto Ranch-San Fern.	°	1.55	2.08	3.63	3.95	.43		4.38	8.01
400	Pasadena-Washington and Palm Ter.	1.16	3.06	2.60	6.82	7.76	1.00		8.76	15.58
401	Verdugo Mt.	1.42	2.36	2.66	6.44	7.85	.86	.02	8.73	15.17

No.	Station	2-27	2-28	3-1	Total	5 PM 3-2	3-3	3-4	Total	Grand Total
402B	State Prison Cmp #35	3.42	.70	2.20	6.32	8.35	1.30		9.65	15.97
403	Altadena - Lindvall	1.47	3.70	2.70	7.87	8.95	.74		9.69	17.56
404	Glendale - Opid	1.39	1.82	1.90	5.11	6.90	.17		7.07	12.18
408	Soledad Cn. - Mitchell	.85	1.61	1.40	3.86	4.60	.40	.10	5.10	8.96
409	Ridge Route (New) State RD	.73	2.16	2.16	5.05	3.78	.97		4.75	9.80
411	Rivera - Pico - Robinson	1.14	.77	1.70	3.61	4.61	.49		5.10	8.71
412	Pasadena-Ohio & Euclid	°	3.50	2.68	6.18	7.56	.44		8.00	14.18
413	Pasadena Central Fire Sta.	°	3.53	2.70	6.23	7.57	.66		8.23	14.46
415	Signal Hill City Hall (L.B.)	1.35	.50	1.14	2.99	3.34	.45		3.79	6.78
416	Altadena - Ventura St.	1.53	2.48	2.34	6.35	8.52	.61		9.13	15.48
417	Lamanda Park - Webber	°	3.72	3.90	7.62	8.07	.68		8.75	16.37
418	Pickens Cn. U.S.F.S. Plots	1.43	3.60	3.14	8.17	8.12	1.06	.01	9.19	17.36
419	Santa Clara River-Mt. Gleason	1.28	2.10	2.05	5.43	9.81	1.85	.45	12.11	17.54
420	Acton - Modie Ranch	°	1.93	1.31	3.24	6.28	1.18	.29	7.75	10.99
421	Mouth of Lopez Cn.	T	1.41	2.41	3.82	4.51	.66		5.17	8.99
423	Wagon Wheel Rch.-Aliso Cn.	1.07	1.18	1.47	3.72	6.63	1.05	.10	7.78	11.50
424	Live Oak Cn. near Dam	1.06	2.08	2.16	5.30	6.50	1.42		7.92	13.22
425	San Gabriel Dam No. 1	1.49	3.85	2.82	8.16	9.90	1.69	.07	11.66	19.82
427	Downey - Jordan	1.65	.51	1.47	3.63	3.92	.50		4.42	8.05
428	Mouth of Eaton Cn.	1.48	3.53	2.70	7.71	8.74	.70		9.44	17.15
508	Arroyo Seco Rgr. Sta.	1.26	2.62	2.62	6.50	8.10	1.00		9.10	15.60
577	L.A. U.S.W.B.	1.47	2.85	.08	4.40	6.17	.49		6.66	11.06
589	Mountain Springs	1.11	1.97	2.42	5.50	5.87	.95		6.82	12.32
593B	Newhall Ranch	°	1.33	1.53	2.86	5.39	.93	.05	6.37	9.23
594	Newhall S.P.R.R.	1.00	1.43	2.08	4.51	5.38	.68	.18	6.24	10.75
612	Arroyo Seco-Chlorine Plt	1.37	2.75	2.70	6.82	8.63	1.07		9.70	16.52
	Hamilton Bowl (L.B. Sump)	1.10	.36	1.15	2.61	3.15	.42		3.57	6.18
	Rossmoyne Fire Area	1.15	2.18	2.10	5.43	7.10	.80	.06	7.96	13.39
619	San Antonio Canyon	.98	3.34	2.35	6.67	7.97	2.22		10.19	16.86
	Woodman & Filmore Ave.	1.15	1.22	1.37	3.74	3.78	.65		4.43	8.17
	Rubio Wash Patrol	1.54	2.05	1.75	5.34	6.87	.51		7.38	12.72
	Pickens Debris Basin	1.22	2.49	2.64	6.35	8.42	.57		8.99	15.34
	Azusa Patrol	1.30	1.96	2.28	5.54	6.92	1.03		7.95	13.49
	Ballona Patrol	1.04	1.17	1.38	3.59	3.90	.31		4.21	7.80
	L.A. River at Imperial	1.23	.36	1.34	2.93	3.69	.50	.06	4.25	7.18

No.	Station	2-27	2-28	3-1	Total	5 PM 3-2	3-3	3-4	Total	Grand Total
	Devil's Gate Dam	1.31	2.38	2.38	6.07	9.43	.69		10.12	16.19
	Eaton Wash Dam	1.46	2.83	2.40	6.69	7.35	.63		7.98	14.67
	Sierra Madre Dam	.60	4.03	3.12	7.75	8.63	1.58		10.21	17.96
623	San Fernando U.S.W.B.	.03	1.31	2.64	3.98	4.46	.49	0	4.95	8.93
627	San Gab. Power House	1.37	2.80	2.60	6.77	6.47	1.61	0	8.08	14.85
629	San Pedro	.09	.85	1.53	2.47	2.25	.38		2.63	5.10
634	Santa Monica	.80	1.70	1.56	4.06	4.11	.85		4.96	9.02
647	Tujunga	1.01	2.12	2.07	5.20	6.02	1.88	0	7.90	13.10
	U. C. L. A.	.27	2.49	2.66	5.42	5.59	.55		6.14	11.56
650	Upland	.10	1.42	3.13	4.65	6.19	1.35	0	7.54	12.19
	Long Beach-Wardlow Rd. and Walnut Ave.	1.33	.35	1.51	3.19	4.02	1.02		5.04	8.23
	No. Hollywood U.S.W.B.	1.40	1.30	1.83	4.53	5.32	.28	0	5.60	10.13
	Glendale (Lytle)	.55	2.78	2.50	5.83	8.30	.21		8.51	14.34
	Arcadia - 637 Michellinda	1.60	2.73	2.35	6.68	7.30	.57		7.87	14.55
536	Echo Mt.	1.78	1.80	2.80	6.38	8.70	1.17		9.87	16.25
556	La Crescenta	1.18	3.76	3.05	7.99	9.42	.94		10.36	18.35
564	Llano	1.27	.47	.58	2.32	1.75	.45		2.20	4.52
575	Long Beach	.02	1.38	1.63	3.03	3.71	.64		4.35	7.38
	L.A. Municipal Airport	.30	1.15	1.71	3.16	3.28	.79	.03	4.10	7.26
587	Mouth San Antonio Cn.	.98	3.34	2.35	6.67	7.96	2.21	0	10.17	16.84
	Neenach	1.17	1.87	.58	3.62	4.78	.25	.10	5.13	8.75
610	Pasadena	1.72	2.53	2.18	6.43	7.70	.68		8.38	14.81
634	Santa Monica	.80	1.70	1.56	4.06	4.11	.85		4.96	9.02
	Backus Ranch(nr.Mojave)	0	.86	.65	1.51	1.76	.32	0	2.08	3.59
	Big Bear Lake Dam	4.62	3.39	1.54	9.55	15.06	2.00	0	17.06	26.61
	Laguna Beach	.98	.61	1.44	3.03	2.32	1.06	.01	3.39	6.42
	Newport Beach	.40	.95	1.39	2.74	1.23	1.98		3.21	5.95
617	Pomona U.S.W.B.	.12	1.45	2.11	3.68	5.39	.99		6.38	10.06
511	Arcadia (U.S.W.B.)	1.60	2.73	2.35	6.68	7.30	.57		7.87	14.55
	Glendale - Kennedy	1.42	1.91	1.94	5.27	7.19	.21		7.40	12.67

° Included in following day's reading.

TABLE III

COMPARATIVE MAXIMUM RAINFALL INTENSITIES
FOR SELECTED MOUNTAIN AND VALLEY STATIONS

		5 Min.	10 Min.	15 Min.	30 Min.	1 Hour	2 Hours	5 Hrs.	24 Hrs.	STORM TOTAL	
										Auto	Std.
Opid's Camp	March 2, 1938	.38	.62	.82	1.20	1.82	3.04	7.60	15.96	16.27inc.	17.38
Previous Max. of Record - Amt.		1.17	1.18	1.18	1.52	2.21	3.80	5.90	13.94	21.34	24.16
	Date	4- 5-26	4- 5-26	4- 5-26	4- 5-26	4- 5-26	4- 5-26	4- 4, 5-26	12-31-33	4- 4, 8-26	
Auto installed	12-14-25	(1.03"=1 min. 4-5-26)									
Hoegge's Camp	March 2, 1938	.30	.43	.57	.83	1.58	2.88	6.29	14.76	15.44	16.49
Previous Max. of Record - Amt.		.41	.47	.58	.90	1.47	2.48		14.76	17.07	19.91
	Date	4-29-35	4-29-35	10-18-36	10-18-36	4- 8-35	4- 8-35		12-31-33	12-30-33	
Auto installed	10-11-26								1- 1-34	1- 1-34	
Clear Creek	March 2, 1938	.54	.62	.67	1.13	1.87	2.86	7.02	14.01	14.85	14.03
Previous Max. of Record - Amount		.35	.42	.54	.82	1.26	1.79		6.30	3.80	4.45
	Date	2-11-38	2-11-38	5- 3-30	8-24-35	8-24-35	2-28-38		2-28	4-3,4,5	4-5-26
Auto installed	11-2-28								3- 1-38	'29	24 Hrs
Camp Baldy	March 2, 1938	.20	.34	.47	.92	1.77	3.41	7.02	11.90inc.	12.05inc.	14.93
Previous Max. of Record - Amt.		.21	.30	.39	.58	1.04	1.91		6.96	9.46	
	Date	2-11-38	2-11-38	3- 1-38	2-28-38	2-28-38	2-28-38 to 3- 1-38		2-28-38to	12-31-33	
Auto installed	11-11-27								3- 1-38	1- 1-34	
Van Nuys	March 2, 1938	.13	.22	.32	.46	.79	1.07	2.05	5.64	5.95	7.38
Previous Max. of Record - Amt.		.24	.31	.39	.55	.82	1.27		6.94	7.85	
	Date	2- 3-31	2- 3-31	2- 3-31	1- 5-35	2- 3-31	2- 3-31		12-31-33	12-30-33	
Auto installed	8-18-30								1- 1-34	1- 1-34	
Sierra Madre	March 2, 1938	.25	.30	.36	.58	.99	1.76	3.20	6.12	6.53	8.47
Previous Max. of Record - Amt.		.34	.48	.58	.68	.96	1.62		8.07	8.81	
	Date	1- 5-35	10-17-34	10-17-34	10-17-34	10-17-34	12-31-33		12-31-33	12-31-33	
Auto installed	12-9-27									1 - 1-34	

TABLE III
Sheet 2

		5 Min.	10 Min.	15 Min.	30 Min.	1 Hr.	2 Hrs.	5 Hrs.	24 Hrs.	Storm Total Auto	Total Std.
Claremont	March 2, 1938	.18	.27	.32	.39	.53	.99	2.28	5.75	6.35	6.32
Previous Max. of Record - Amt.		.23	.30	.36	.58	.92	1.47		7.86	8.87	
	Date	10-17-34	8-25-35	10-17-34	10-17-34	1- 1-34	1- 1-34		12-31-33	12-31-33	
Auto installed	12-2-27								1- 1-34	1- 1-34	
Hancock Park	March 2, 1938	.30	.36	.38	.58	.93	1.69	3.13	5.67	5.90	5.90
Previous Max. of Record - Amt.		.30	.50	.62	.96	1.41	1.57		6.83	7.70	
	Date	10-17-34	10-17-34	10-17-38	10-17-34	10-17-34	10-17-34		12-31-33	12-31-33	
Auto installed	1-13-29								1- 1-34	1- 1-34	
Los Angeles	March 2, 1938	.18	.29	.38	.66	.90	1.44	3.06	6.28	6.66	
Previous Max. of Record - Amt.		.42	.65	.70	1.14	1.51	1.99	2.91	7.36		
	Date	1-14-08	2-18-14	2-18-14	2-18-14	2-18-14	2-18-14	2-18-14	12-31-33		
Auto installed	2-19-97								1- 1-34		

MAXIMUM ONE HOUR INTENSITIES
STORM OF MARCH 2, 1938

TABLE IV

No.	Station	Amt. Inches A.M.	Time Interval	Amt. Inches P.M.	Time Interval	Remarks
6	Topanga Ranger Sta.	1.09	6:57a - 7:57a	.47	11:01a - 12:01p	
10	Bel Air	.94	6:59a - 7:59a	.34	3:29p - 4:29p	
11	Upper Franklin Res.	Gage not working properly				
15	Van Nuys	.52	5:40a - 6:40a	.79	11:15a - 12:15p	
33A-E	Pacoima Dam	.72	8:40a - 9:40a	.48	12:03p - 1:03p	Gage reached Cap. at 2:40p
47A	Clear Creek	1.87	8:53a - 9:53a	1.49	11:28a - 12:28p	
51	Headlee's Camp	-	-	(3.10)	12:30p - 2:30p	Rate 1.55/hour
52	Switzer's Camp	1.16	9:02a - 10:02a	1.28	1:48p - 2:48p	
53A	Sleepy Hollow Ranch	1.11	8:49a - 9:49a	1.33	1:56p - 2:56p	
57B-E	Opid's Camp	1.81	9:19a - 10:19a	1.82	3:10p - 4:10p	Gage at capacity 2:18p. Inter- polation from glass graduate made after 2:18p
60A	Hoegge's Camp	1.28	8:40a - 9:40a	1.58	3:02p - 4:02p	
65	Sierra Madre	.99	8:17a - 9:17a	.63	12:03p - 1:03p	Gage reached Cap. at 1:54p.
70	Dalton No. 1	.92	7:31a - 8:31a	.57	1:27p - 2:27p	
85D	Camp Baldy	.96	9:29a - 10:29a	1.78	1:56p - 2:56p	
92	Claremont	.53	7:00a - 8:00a	.53	1:10p - 2:10p	
124B	Bouquet Canyon Res.	.70	8:00a - 9:00a	.85	2:00p - 3:00p	
150	Monrovia Falls	.98	8:07a - 9:07a	1.06	1:24p - 2:24p	Gage completely covered with mud at 2:24p
158	Tanbark Flats	.98	9:00a - 10:00a	1.57	2:29p - 3:29p	
178	Azusa-Griffith	.76	7:00a - 8:00a	.45	1:54p - 2:54p	
210B	Brand Park	.84	8:39a - 9:39a	.75	11:26a - 12:26p	
213	Hancock Park	.93	6:11a - 7:11a	.27	3:31p - 4:31p	
228B	Beverly Hills City Hall	.89	5:40a - 6:40a	.17	12:50p - 1:50p	
235	Henninger Flats	.99	9:03a - 10:03a	.95	2:41p - 3:41p	
257	Griffith Park	.94	7:58a - 8:58a	.40	12:55p - 1:55p	Gage reached
259B	Chatsworth Patrol Sta.	.73	7:50a - 8:50a	.52	11:25a - 12:25p	Cap. at 1:25 PM

TABLE IV

TABLE IV
Sheet 2

No.	Station	Amt. Inches A.M.	Time Interval	Amt. Inches P.M.	Time Interval	Remarks
261E	Acton-Mellen	.26	8:42a - 9:42a	.37	2:19p - 3:19p	
280	Flintridge Fire Station	.91	8:44a - 9:44a	.80	1:31p - 2:31p	
283a	Crystal Lake-East Pine	1.18	8:44a - 9:44a	1.69	1:06p - 2:06p	
289	Laguna Bell	.67	3:37a - 4:37a	.52	3:56p - 4:56p	
290	Newmark	.66	3:44a - 4:44a	.65	3:41p - 4:41p	
291	96th and Central	.63	3:15a - 4:15a	.20	12:58p - 1:58p	
303	Cal-Tech	.94	7:48a - 8:48a	.68	2:01p - 3:01p	
311	Sunset Res. (Pasadena)	1.07	8:00a - 9:00a	.60	2:00p - 3:00p	
334E	San Gabriel Dam No. 2	1.26	8:50a - 9:50a	1.61	11:50a - 12:50p	Gage reached Cap. at 12:50 pm
338	Mt. Wilson	1.11	8:42a - 9:42a	1.32	11:41a - 12:41p	
348B	Honor Camp No. 4	.78	9:30a - 10:30a	1.12	2:41p - 3:41p	
352	Lechusa Patrol Station	.82	7:13a - 8:13a	.66	10:52a - 11:52a	
367	Upper Haines	.98	8:43a - 9:43a	1.31	11:44a - 12:44a	Gage reached Cap. at 2:49 PM
373	Briggs Terrace	1.09	8:41a - 9:41a	1.13	12:57p - 1:57p	
379	San Gabriel-East Fork	1.20	8:00a - 9:00a	1.32	1:50p - 2:50p	
380	El Sereno	.88	7:20a - 8:20a	.52	1:39p - 2:39p	
400	Washington & Palm Terr. (Pasadena)	1.12	7:50a - 8:50a	.74	2:50p - 3:50p	
402B	State Prison Camp #35	.65	9:07a - 10:07a	1.08	2:50p - 3:50p	
404	Glendale - Opid	.92	8:30a - 9:30a	.58	1:10p - 2:05p	= 55 Min. Rate .63 per hour
415	Signal Hill City Hall	.46	8:00a - 9:00a	.33	12:23p - 1:23p	Clock stopped be- tween 3:58am- 9:00am. Inter- polated from Hamilton Bowl
418	Pickens Canyon	1.12	9:18a - 10:18a	.80	12:25p - 1:25p	
419	Mt. Gleason	.67	9:13a - 10:13a	.96	2:50p - 3:50p	
425	San Gabriel Dam No. 1	1.03	8:07a - 9:07a	1.03	1:48p - 2:48p	
577	Los Angeles (U.S.W.B.)	.90	7:37a - 8:37a	.44	3:30p - 4:30p	
	Rossmoyne Fire Area	1.30	8:37a - 9:37a	.81	12:53p - 1:53p	
	Tampico St. (L.A. City Storm Drain Dept.)	.78	7:26a - 8:26a			

TABLE IV
Sheet 3

No.	Station	Amt. Inches A.M.	Time Interval	Amt. Inches P.M.	Time Interval	Remarks
46	Big Tujunga Dam	.83	9:00a - 10:00a	(2.30)	12:00p - 2:00p	Rate 1.15"/hr.
	Devil's Gate Dam	(1.14)	9:00a - 10:00a	1.10	1:00p - 2:00p	
	Eaton Dam	.90	8:00a - 9:00a	.75	2:00p - 3:00p	
89	San Dimas Dam	.66	9:00a - 10:00a	.64	4:00p - 5:00p	
	Live Oak Dam	.68	9:00a - 10:00a	.53	1:00p - 2:00p	
63	Santa Anita Dam	.96	8:00a - 9:00a	-	-	
68	Sawpit Dam	.60	8:00a - 9:00a	.88	2:00p - 3:00p	
	Sierra Madre Dam	.87	8:25a - 9:25a	.85	3:00p - 4:00p	
	Thompson Creek Dam	.61	7:00a - 8:00a	.78	1:00p - 2:00p	
	Pickens Debris Basin	1.01	8:20a - 9:20a	.95	1:40p - 2:40p	
	Verdugo Debris Basin	(.61)	9:02a - 9:31a=29Min.	.63	1:50p - 2:50p	Rate=1.26/hr.
	Brand Park Debris Basin	.61	8:55a - 9:55a	.83	11:05a - 12:05p	No intensity taken prior to 8:55 a.m.
	Hall-Beckley Debris Basin	(1.08) Rate/hour	9:20a - 9:50a= $\frac{1}{2}$ Hr.	(.85)	1:26p - 2:14p=48 Min.	Rate 1.06"/hour
	Azusa Patrol Station	.75	8:00a - 9:00a	.63	1:45p - 2:45p	
	Ballona Cr. Patrol Sta.	.55	5:40a - 6:40a	.10	1:30p - 2:30p	
	L.A. River at Imperial Hwy.	.51	5:20a - 6:20a	.33	3:00p - 4:00p	
	Rubio Wash at Broadway	.76	7:40a - 8:40a	.50	1:40p - 2:40p	
	San Fernando Valley Woodman Ave. at Fillmore Ave.	.29	3:00a - 4:00a	.32	11:15a - 12:15p	

TABLE V

RAINFALL OF MARCH 2, 1938 FOR RECORDS
SUBJECTED TO FREQUENCY ANALYSIS

No.	Station Name	Daily Rainfall March 2 or 3 1938	Years of Record	Probable Freq. of Days Rain in Years	No. of Records Higher	Previ- ous Max. Record Value
	U.S. Weather Bureau-L.A.	5.87	50	275	0	4.86
636	Santa Monica-Sulliger	4.60	44	82	1	4.64
178	Azusa-Griffith	5.86	44	19	4	7.18
119	Santa Monica Soliders Home	5.31	41.2	73	1	8.14
92	Pomona-Brackett	5.19	41	17	2	7.82
594	Newhall	5.38	39	20	3	6.02
179	Sierra Madre-Carter	8.61	38.6	102	0	7.84
187	San Dimas - Mount	6.17	38.2	25	2	6.98
638	Sierra Madre-Blumer	8.31	36.3	66	0	7.47
274	Acton	2.82	35	7	6	3.75
590	Mt. Wilson(W. Bureau)	7.97	29.8	13	2	11.00
21	Brant Ranch	5.33	24.1	56	0	4.55
612	Pasadena Chlorine Plant	8.63	21.8	46	1	9.40
99	Azusa Footnill Ranch	6.61	21.8	15	2	9.53
195	Claremont-Bernard	5.55	20	9	3	7.77
62	Santa Anita Ranger Sta.	10.64	19.9	112	0	8.70
621	San Dimas Orange Growers	6.20	19.8	30	0	5.86
208	Artesia-Barr	4.40	19	189	0	3.22
225	Montana Ranch	3.24	19	13	2	4.00
30	Sylmar	4.35	18.9	29	1	5.26
266	Leffingwell Ranch	5.01	18	168	0	4.07
85	Camp Baldy	11.67	17.2	55	0	10.65
25	Zelzah	5.43	17.2	63	1	6.00
356	Diamond Bar Ranch	4.78	17.1	13	1	6.62
399	Glendale-Preston	6.90	17	34	1	7.15
617	Pomona-Adamson	4.21	16.3	8	3	5.60
176	Rubio Cn. Land & Water	8.20	16.2	195	0	6.91
127	Dry Canyon	2.31	16	3	5	7.15
194	Covina-Evans	5.13	15.8	28	1	8.30
28	San Fernando Lemon Growers	3.03	15.2	5	3	7.55
417	Lamanda Park	5.70	15.2	35	1	11.42
279	Kinneloa Ranch	8.70	15.2	48	1	9.20
416	Altadena	8.52	15.2	328	0	5.87

MEAN

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NOTE: Sequence of Table is by Length of Record.

5.

TABLE VI

COMPARISON OF STORM RAINFALL DURING KNOWN FLOOD PERIODS FOR SELECTED STATIONS

No.	Station	2/27- 3/4/38	12/29- 1/2/34	2/12-16/ '27	4/4-8/26	12/17-23 '21	1/14-19 '16	2/18-21 '14	12/22-26 '89	2/14-18 '84
577	L. A. U.S.W.B.	Max.day <u>5.88</u>	4.86	2.40	2.74	2.12	4.16	4.26	2.72	2.18
	Storm total	<u>11.06</u>	8.27	6.38	7.34	5.72	6.90	7.04	7.05	5.70
594	Newhall	Max.day <u>5.38</u>	5.55	3.63	3.11	<u>6.02</u>	Missing	2.87	-	-
	Storm total	10.75	8.21	9.79	8.25	<u>13.45</u>		9.02	-	-
185	Glendora	Max.day <u>6.70</u>	8.20	5.42	5.77	3.50	5.80	6.75	4.05	3.25
	Storm total	13.72	<u>16.24</u>	11.09	10.20	9.23	14.02	13.05	8.07	10.23
224	Long Beach	Max.day <u>3.70</u>	2.32	3.17	3.09	1.81	1.38	1.24	-	-
	Storm total	<u>7.29</u>	3.94	5.14	4.85	3.98	4.95	3.24	-	-
53	Colby's Rch.	Max.day <u>10.95</u>	8.01	7.24	8.26	Missing	Missing	Missing	-	-
	Storm total	18.81	11.64	16.28	23.21	<u>29.00</u>	18.50	22.50	-	-
75	San Gabriel	Max.day <u>9.90</u> (Dam 1)	7.62	8.15	6.60	<u>15.46</u>	Missing	7.55	-	-
	Intake Storm Tot. (Dam 1)	19.82	13.31	16.30	13.01	<u>25.08</u>	Missing	14.24 inc.	-	-
590	Mt. Wilson	Max.day <u>12.57</u>	9.40	5.89	6.80	11.00	6.38	6.38	7.93	-
	Storm total	<u>26.23</u>	15.48	14.46	14.62	23.03	13.40	19.40	13.86	-
587	Mo. San Antonio	Max.day <u>7.96</u>	5.04	7.23	4.68	4.18	-	-	-	-
	Storm total	<u>16.84</u>	9.79	11.43	9.81	14.06	-	-	-	-
57	Opid's Camp	Max.day <u>15.28</u>	9.10	7.89	12.52	Missing	-	-	-	-
	Storm total	27.27	17.93	19.39	24.16	<u>29.60</u> inc.	-	-	-	-
Average percentage values of 1938 storm										
	Max.day	100	80	68	68	78	62	65	56	43
	Storm total	100	71	74	74	95	76	79	58	63

NOTE: - Maximum values for each station are underscored.
Maximum day values are as recorded by observer.

PEAK FLOW ESTIMATES - STORM OF MARCH 2, 1938

TABLE VII

Index No.	Stream	Location	Drainage Area Square Miles	Estimated Peak Discharge Sec.Ft.	Discharge in Sec.Ft.per Sq. Mile	Classi- fication of Estimates
1	Los Angeles River	Van Nuys Boulevard	157	12,100	77	4-A
2	Los Angeles River	Vineland Avenue		37,700		4-A
3	Los Angeles River	Dayton Avenue	510	68,000	133	4-A
4	Los Angeles River	Stewart and Gray Road	614	79,700	130	4-B
5	Los Angeles River	State Street		99,100		4-B
6	Arroyo Calabasas	Shoup Avenue	11.11	2,380	214	4-B
7	Brown's Canyon	Above Devonshire St.	14.3	1,075	75	2-B
8	Wilson Canyon	At Olive View Sanatorium	2.57	460	179	4-A
9	Loop Canyon	Above Veterans' Hospital	1.06	1,820	1,717	4-B
10	Caballero	Above Ventura Boulevard	2.97	720	242	4-B
11	Laurel Ave. Lateral	Above Ventura Boulevard	1.75	395	226	4-B
12	Pacoima	Pacoima Dam	27.77	8,150	293	1
13	Pacoima	Laurel Canyon Boulevard	50.6	6,000		4-B
14	Little Tujunga	Above Buck Canyon	2.17	1,470	677	4-B
15	Little Tujunga	At mouth of Canyon	19.3	8,540	442	4-B
16	Gold Canyon	At junction with Little Tujunga	7.94	1,860	234	4-B
17	Big Tujunga	Big Tujunga Dam	81.35	34,000	418	1
18	Big Tujunga	At Submerged Dam	106	50,000	472	3-B
19	Big Tujunga	Station F213R	106	46,300	437	4-B
20	Big Tujunga	Stonehurst Ave.-Sta. F20R	148	53,800	364	4-B
25	Mill Creek	Above North Fork	15.68	3,300	210	4-B
26	Mill Creek	Below North Fork	21.50	12,700	591	4-B
27	North Fork Mill Creek	500 Ft. above mouth	5.82	7,300	1,254	4-B
28	Lucas Canyon	Near mouth	1.66	465	280	4-B
30	Lucifer Creek	Near mouth	0.59	635	1,076	4-B
32	Fall Creek	Near mouth	2.23	4,200	1,883	4-B
35	Trail Canyon		6.76	4,970	735	4-B
36	Gold Canyon		2.65	1,700	642	4-B

TABLE VII

Index No.	Stream	Location	Drainage Area Square Miles	Estimated Peak Discharge Sec.Ft.	Discharge in Sec.Ft.per Sq.Mile	Classi- fication of Estimates
37	Dunsmuir Canyon	Debris Basin	0.86	940	1,093	3-A
38	Pickens Canyon	Debris Basin	1.84	1,270	690	3-A
39	Hall-Beckley Canyon	Debris Basin	0.84	920	1,095	3-A
40	Verdugo	Debris Basin	15.24	4,300	282	3-A
41	Verdugo	Estelle St. - Sta. F252R	22.4	4,500	201	2-B
42	Arroyo Seco	Station U 1 at Ranger Sta.	16.4	9,500	579	4-B
43	Arroyo Seco	Above Millard Canyon	18.9	7,150	378	4-B
44	Arroyo Seco	Devil's Gate Dam	30.62	11,400	372	1
45	Arroyo Seco	Colorado Street	36.0	8,600	239	4-A
46	Millard Canyon		2.74	5,150	1,880	4-B
47	Brand Canyon	Debris Basin	1.03	130	126	3-A
48	Nichols Canyon	Debris Basin	0.99	260	263	3-A
49	City Terrace Wash	1/4 mi. South of Valley Blvd.	5.05	2,286	453	4-B
50	City Terrace Wash	1/2 mi. North of McBride Ave.	7.13	3,160	443	4-B
51	Monterey Wash	1/4 mi. North of 3rd Street	0.57	312	547	4-B
52	La Merced Wash	800 Ft. North of Beverly Blvd.	0.24	64	267	4-B
53	Compton Creek	1000 Ft. below Alameda St.	47	2,360	50	2-A
54	Ballona	Sawtelle Ave. Sta. F38B-R	112	22,500	201	2-A
55	Benedict Canyon	Station F 235 R	6.96	648	93	4-A
56	Sepulveda	Station F 185R	25.68	3,136	122	4-B
57	Centinella	Station F 186 R	5.17	2,043	395	4-B
58	Santa Monica Canyon	Above Rustic Canyon	8.15	1,330	163	4-B
60	Rustic Canyon	Station F 238 S	7.23	2,260	313	4-B
61	Topanga Canyon	Station F 54 R	18.0	8,800	489	4-A
62	Malibu Creek	Station F 130 R	103	10,000	97	5
63	Rio Hondo	Lower Azusa Road, Sta.F192 R		28,000		5
64	Rio Hondo	Mission Bridge, Sta F 64 R		22,600		4-A
65	Rio Hondo	Stewart & Gray Rd. Sta.F 45 R		24,400		4-B
66	Montebello Storm Dr.	Station F 181 R	9.6	1,395	145	2-B
67	Alhambra Wash	Station F 81D R	14.5	4,170	288	2-B
69	Rubio Canyon	Rubio Falls	0.88	2,000	2,273	3-B

Index No.	Stream	Location	Drainage Area Square Miles	Estimated Peak Discharge Sec.Ft.	Discharge in Sec.Ft.per Sq.Mile	Classi- fication of Estimates
70	Rubio Wash	Station F 82 C R	14.0	2,660	190	2-B
72	Eaton Wash	Debris Dam	9.48	2,225	235	1
73	Eaton Wash	Below Duarte Road	14.03	2,800	199	4-B
74	Eaton Wash	Station F 104 R	18.4	2,500	136	4-A
75	Pasadena Glen	At Falls 1/4 Mi. above end of road	0.78	2,800	3,589	3-B
76	Little Santa Anita	Sierra Madre Dam	2.39	700	293	1
77	Little Santa Anita	Station F 67 B-R	2.47	630	255	2-B
79	Santa Anita	Station U 4	10.5	4,300	410	2-B
80	Santa Anita	Big Santa Anita Dam	10.82	4,600	425	1
83	Gold Hill Canyon		0.49	138	282	4-B
84	Kelly Canyon		0.16	125	782	4-B
85	Monrovia Storm Drain	Station F 195 R	4.47	775	173	4-B
88	Sawpit Canyon	Above Vassar Canyon	2.63	1,020	388	3-B
89	Vassar Canyon	Junction with Sawpit Canyon	0.38	150	395	3-B
90	Sycamore Canyon	Junction with Sawpit Canyon	0.35	340	972	3-B
91	Tributary	From East above Sawpit Dam	0.10	180	1,800	3-B
92	Sawpit	Sawpit Dam	3.27	1,120	342	1
94	Sawpit	Foothill Boulevard	6.33	2,140	338	4-A
95	San Gabriel	Dam No. 1	202.16	94,380	467	1
96	San Gabriel	Foothill Blvd. Sta. F190 R	230	51,000	222	4-B
97	San Gabriel	Beverly Blvd. Sta. F263 R		25,800		4-B
98	San Gabriel	Easy Street, Station F 262 R		29,000		2-B
99	San Gabriel	Spring Street, Sta. F 180 R		26,000		4-B
100	Devil's Canyon	Sta. F 227 R above San Gabriel Dam No. 2	15.4	23,000	1,493	5
101	West Fork San Gabriel	Sta. F 228 R above San Gabriel Dam No. 2	14.4	15,000	1,041	5
102	West Fork San Gabriel	Dam No. 2	40.42	23,800	588	1
103	West Fork San Gabriel	Station F 209 R	40.8	25,000	611	5
104	West Fork San Gabriel	Station P 3 R	102	34,000	333	5
105	Bear Creek	Boy Scout Camp, Sta. F99B-R	27.1	12,500	645	4-B

Index No.	Stream	Location	Drainage Area Square Miles	Estimated Peak Discharge Sec.Ft.	Dis charge in Sec.Ft.per Sq.Mile	Classi- fication of Estimates
107	East Fork San Gabriel	Station P 4 R	91.4	40,000	438	4-A
110	Rogers Creek	1500 Ft. above Station U 6 R	6.12	8,280	1,352	4-B
111	Little Dalton	Above Little Dalton Road	3.09	960	310	3-B
112	Little Dalton	Above Sierra Madre Ave.	3.63	703	194	4-A
113	Little Dalton	Below Bonita Avenue		1,490		4-B
114	Englewild Canyon	Above Highland Ave.	0.87	146	168	4-B
115	Harrow Canyon		0.50	154	308	4-B
116	Big Dalton	Big Dalton Dam	4.49	1,300	290	1
117	Big Dalton	Below Foothill Blvd.	8.03	1,140	142	4-B
118	Big Dalton	Azusa Ave.	15.3	1,640	107	4-B
119	Big Dalton	Above Holt Ave.	20.28	2,120	104	4-B
120	Big Dalton Tributary	From East near Alosta Ave.	3.29	377	114	4-B
121	San Dimas	San Dimas Dam	15.92	4,400	276	1
122	San Dimas	Puddingstone Diversion Dam	18.49	5,550	300	1
123	Puddingstone	Puddingstone Dam	33.13	5,850	177	1
125	San Dimas	1/4 mi. above Grand Ave.	24.77	1,860		4-B
126	San Dimas	Near Covina Blvd.	28.16	1,710		4-B
127	Sycamore Canyon		0.87	504	580	4-B
128	Halm Canyon		0.98	522	533	4-B
129	Lodi Canyon		1.60	1,030	643	4-B
130	Walnut Creek	Near Walnut Ave.	64.0	3,650		4-B
131	Walnut Creek	Station F 47 R	99	4,400		2-A
132	Walnut Cr. Tributary	Crossing San Dimas Ave. at Cienega Ave.	0.77	299	389	4-B
133	Walnut Cr. Tributary	Below Rowland Ave.	3.53	784	222	4-B
134	San Jose Creek	Collins Ave.	15.3	909	59	4-B
135	San Jose Creek	Anaheim-Puente Road	54.84	6,930	126	4-B
136	San Jose Creek	Station F 48 R	85	8,800 ✓	104	2-A
137	Lemon Wash	Above Valley Blvd.	2.55	290	114	4-B
138	San Jose Cr. Tributary	From South 1/4 mi. below Lemon at Walnut	4.81	287	60	4-B

Index No.	Stream	Location	Drainage Area Square Miles	Estimated Peak Discharge Sec.Ft.	Discharge in Sec.Ft.per Sq.Mile	Classification of Estimates
139	San Jose Cr. Tributary	From South near Mill District School	0.38	92	242	4-B
140	San Jose Cr. Tributary	From South 1/4 Mi. below Hacienda Blvd.	0.37	312	843	4-B
141	Sycamore Canyon	Tributary S.G.River below Workman Mill Road	1.52	280	184	4-B
142	Turnbull Canyon	1-3/4 Mi.North of Whittier Bl.	0.82	336	410	4-B
143	Turnbull Canyon	1-1/2 Mi.North of Whittier Bl.	0.95	360	379	4-B
144	Unnamed Wash	Whittier Blvd. and Center St.	1.05	124	118	4-B
145	Woods Wash		1.64	202	123	4-B
146	Murphy Ranch Wash		1.95	310	159	4-B
147	Leffingwell Ranch Wash		0.66	115	174	4-B
148	Hacienda Wash	1/2 Mi.North of Whittier Blvd.	2.84	279	98	4-B
149	Rodeo Canyon		6.09	514	84	4-B
150	Sycamore Cn. Wash	(Tributary to Rio Hondo)	1.36	603	443	4-B
151	Rio Hondo Tributary	500 Ft.East of San Gabriel Blvd. & Mission Rd.	1.44	527	366	4-B
152	Coyote Creek	Station F 41 C R	110	3,660	33	2-A
153	Marshall Creek	Below Baseline Ave.	2.80	410	146	4-B
154	Emerald Wash	Below Baseline Ave.	1.18	374	317	4-B
155	Live Oak	Live Oak Dam	2.30	355	154	1
156	Live Oak	Station F 31 R	2.57	260	101	2-B
157	Live Oak	Above Foothill Blvd.	2.77	348	126	4-B
158	Thompson Creek	Thompson Creek Dam	3.91	600	154	1
159	Thompson Creek	Station F 32 S	6.89	125		4-B
160	Thompson Creek	Below Foothill Blvd.	7.43	400		4-B
161	San Antonio	Station F 151 R	28.0	23,400	836	4-B
162	Santa Clara	Station F 92 R 4 Mi. West of Saugus	355	24,000	68	4-B
163	Elizabeth Lake Creek	Station F 141 S	67	5,000	75	4-B
164	Castaic Creek	Above Elizabeth Lake Creek	83.43	14,500	174	4-B

TABLE VII - Page 6

Index No.	Stream	Location	Drainage Area Square Miles	Estimated Peak Discharge Sec.Ft.	Discharge in Sec.Ft.per Sq.Mile	Classi- fication of Estimates
165	Castaic Creek	At Highway 99	191.71	21,600	113	4-B
166	Little Rock Creek	Above Station L 1 R	49.0	17,000	346	4-B
167	Santiago Creek	Station F 125-S	11.37	5,430	477	4-B

Note: Omission of a figure for Discharge per Square Mile indicates uncertain drainage area or effective regulation of portion of tributary drainage.

COMPARISON OF FLOOD PEAKS DURING STORM OF MARCH 2, 1938 WITH PREVIOUS FLOOD PEAKS

Major Stream Channels

TABLE VIII

<u>Location</u>	<u>Area</u>	<u>March 2, 1938</u>	<u>1-1-34</u>	<u>2-16-27</u>	<u>1916</u>	<u>1914</u>	<u>1889</u>	<u>1884</u>
<u>LOS ANGELES RIVER</u>								
Van Nuys Blvd.	157	12,100	7,380(9)					
Vineland Blvd.		37,700	9,140(9)					
Lankershim Blvd.	411.5					16,780(1)		
Filtration Galleries	334.8					24,420(1)		
Dayton Ave.	510	68,000	22,000(9)		7,268(8)			
Broadway Bridge	555.4						45,000(7)	
Main St. Bridge	556.7					31,140(1)	38,000(1)	30,000-
Stewart & Grey Rd.	614	79,700	29,400(9)	21,400(6)				35,000(1)
Dominguez Jct.					31,113(8)			
Willow St.				51,200(6)				
State St.		99,100	37,500(9)					
<u>ARROYO SECO</u>								
U.S.G.S. Station	16.4	9,500			3,150(5)	5,630(11)		
Above Millard Cn.	18.9	7,150						
Devil's Gate Dam	30.62	11,400	3,305(9)			11,400(1)		
Colorado St.	36.00	8,600				14,136(1)		
San Pasqual	38.1					7,610(1)		
Avenue 36	43.9					5,880(1)		
L.A. River	45.0				6,215(8)			

TABLE VIII -Continued

<u>Location</u>	<u>Area</u>	<u>March 2, 1938</u>	<u>1-1-34</u>	<u>1916</u>	<u>1914</u>	<u>1884</u>
<u>SAN GABRIEL RIVER</u>						
Forks	200(3)				61,276(3)	
San Gabriel Dam No. 1	202	94,380	18,000(9)			
Horseshoe Bend					75,460(3)	
Mouth	220(1)				25,260(1)	
Mouth	222(8)			40,000(8)	18,100(8)	47,000(1)
Mouth	228.68(1)				26,680(1)	
Foothill Blvd.	230(9)	51,000	5,550(9)			
Beverly Blvd.		25,800				
Whittier Blvd.			22,000(9)			
3/4 Mile below Whittier Blvd.					16,000(1)	
Easy St.		29,000				
Spring St.		26,000	15,000(9)			
<u>RIO HONDO</u>				<u>1927</u>		
Lower Azusa Rd.		28,000	5,860(9)			
Valley Blvd.				25,330(4)		
Mission Bridge		22,600	11,800(9)	13,543(4)		
Whittier Blvd.					26,806(5)	
Downey Rd.					20,930(1)	
Stewart & Grey		24,400	16,000(9)			

COMPARISON OF FLOOD PEAKS DURING STORM OF MARCH 2, 1938 WITH PREVIOUS FLOOD PEAKS

Minor Stream Channels

TABLE IX

Index No.	Stream	Location	Drainage Area	Peak Flow 3-2-38	1-1-34	2-16-27	4-7-26	Other Dates
12	Pacoima	Pacoima Dam	27.77	8,150		1,860(10)		1914- 5,400(5)
15	Little Tujunga	Mouth of Cn.	19.3	8,540	1,360(9)			1914- 4,100(1)
20	Big Tujunga	Stonehurst Ave.	148	53,800	3,750(9)			1914- 13,600(1)
41	Verdugo	Estelle St.	22.4	4,500				1914- 7,700(1)
53	Compton Creek	Below Alameda St.	47	2,360				
	Compton Creek	Rosecrans	21.7		960(9)			
54	Ballona	Sawtelle Ave.	112	22,500	11,300(9)			
		Higuera Rd.	76					1914- 6,480(1)
61	Topanga	Above mouth	18.0	8,800	4,510(9)			
67	Alhambra Wash	Sta. F 81-D	14.5	4,170				
	Alhambra Wash	Sta. F 81	12.4		4,890(9)			
70	Rubio Wash	Sta. F 82 CR	14.0	2,660				
	Rubio Wash	Broadway	13.0		2,070(9)			
72	Eaton Wash	Debris Dam	9.48	2,225				
	Eaton Wash		12.50					1914- 4,590(1)
	Eaton Wash	U.S.G.S.Sta.	6.5				1,360(10)	
74	Eaton Wash	Sunset Rd.	18.4	2,500	2,180(9)			
79	Santa Anita	U.S.G.S.	10.5	4,300			2,800(10)	
82	Santa Anita	Below Sierra Madre Drain	19.4					1914- 3,168(1)
85	Monrovia Storm Drain	Peck Road	4.47	775	554(9)			
94	Sawpit Creek	Foothill Blvd.	6.33	2,140				
	Sawpit		7.37					1914- 4,070(1)
112	Little Dalton	Sierra Madre Ave.	3.63	703				
	Little Dalton		3.34		201(9)			1914- 1,018(1)
117	Big Dalton	Foothill Blvd.	8.03	1,140				1914- 1,070(1)
	Big Dalton		7.56					
	Big Dalton	U.S.G.S.	7.5			660(10)		

Minor Stream Channels

TABLE IX Continued

<u>Index No.</u>	<u>Stream</u>	<u>Location</u>	<u>Drainage Area</u>	<u>Peak Flow 3-2-38</u>	<u>1-1-34</u>	<u>2-16-27</u>	<u>4-7-26</u>	<u>Other Dates</u>
122	San Dimas	Puddingstone Div.	18.49	5,550				1914- 2,950(1)
	San Dimas	U.S.G.S.	18.3					1922- 1,140(10)
131	Walnut Creek	Covina Blvd.	99	4,400	8,060(9)			1914- 3,875(5)
136	San Jose Cr.	Workman-Mill Rd.	85	8,800	13,100(9)	10,320(4)		1914- 9,073(5)
152	Coyote Creek	So. of Artesia	110	3,660	2,020(9)			1934-Dec. 3,190(9)
161	San Antonio	Mo. of Canyon	28	23,400	200(9)			1932- 405(9)
162	Santa Clara River	Old Highway 99	355	24,000	3,870(9)			
166	Little Rock	Above Santiago	49	17,000				1932- 2,200(9)

AUTHORITIES FOR FLOOD PEAK ESTIMATES PREVIOUS

TO MARCH 2, 1938

- (1) Board of Engineers Flood Control Report to
 Board of Supervisors July 27, 1915
- (2) J. B. Lippincott
- (3) Report upon Maximum Flood Discharges in the San Gabriel
 Watershed by Bell, Hawgood & Conkling September, 1925
- (4) Division of Water Rights, State of California
- (5) W. S. P. 447
- (6) Pasadena Water Department
- (7) H. Hawgood Report February 8, 1902
- (8) W. S. P. 426
- (9) Flood Control District Yearly Runoff Report
- (10) U.S.G.S. Water Supply Papers
- (11) U.S.G.S. Water Supply Paper 636-E

PEAK RUNOFF DATA AT DISTRICT RESERVOIRS

TABLE X

Dam	Drainage Area Sq.Mi.	Data for Storm of March 2, 1938				Data for Computed Capital Flood		
		Peak Flow Sec.Ft.	Peak per Sq.Mi.	Max.Hr. Rainfall in P.M. in Inches	Runoff Coeffi- cient	Theoretical Time of Concentra- tion	Rainfall Intensity for con- centration time In./Hr.	Runoff Coeffi- cient
San Gabriel Dam #1°	202.16	94,380	467	1.43	.51	1-1/3 Hr.	1.78	.53
Big Tujunga	81.35	34,000	418	1.16	.56			
San Gabriel Dam #2	40.42	23,800	589	1.49	.62			
Puddingstone°°	33.13	5,850	177	.95	.29			
Devil's Gate	30.62	11,400	372	1.27	.46	2.1 Hrs.	1.46	.48
Pacoima	27.77	8,150	294	.78	.59			
Puddingstone Diversion°°°	18.49	5,550	300	1.24	.38	1/2 Hr.	3.00	-
San Dimas	15.92	4,400	276	1.31	.33	3/4 Hr.	2.70	.55
Santa Anita	10.82	4,600	425	1.40	.47	1/3 Hr.	5.00	.41
Eaton	9.48	2,225	235	1.14	.32			
Big Dalton	4.49	1,300	290	1.13	.40			
Thompson	3.91	600	154	.95	.25			
Sawpit	3.27	1,120	342	1.04	.52			
Sierra Madre	2.39	700	293	1.19	.39			
Live Oak	2.30	355	154	.89	.27			

° Data includes tributary area above San Gabriel Dam No. 2.

°° Data includes tributary area above San Dimas Dam, Puddingstone Diversion Dam and Live Oak Dam.

°°° Data includes tributary area above San Dimas Dam.

Note - Data for computed Capital Flood for Puddingstone Diversion Dam includes local tributary area of 2.57 square miles only.

VOLUMES OF RUNOFF AT FLOOD CONTROL RESERVOIRS
STORM OF MARCH 2, 1938

TABLE XII

Dam	Time of Maximum 24 Hr. Runoff	Maximum 24 Hr. Runoff		Max. Day's Rain- fall 5P3/1- 5P3/2	24 Hr. yield in %	Runoff for 24 Hr. Periods following Max.			
		Acre Feet	Inches Depth			1st 24 Hours Ac.Ft.	% of Max. day's Rainfall	2nd 24 Hours Ac.Ft.	% of Max. Day's Rainfall
San Gabriel Dam #1°	10:10A 3/2- 3/3	76,730	7.12	11.15	64	20,711	17	10,822	9
Big Tujunga	8A 3/2-3/3	24,872	5.73	9.08	63	3,109	8	1,489	4
San Gabriel Dam #2	7A 3/2-3/3	16,012	7.43	12.33	60	2,403	9	1,133	4
Muddingstone°	7A 3/2-3/3	5,318	3.01	8.01	38	972	7	314	2
Devil's Gate	7A 3/2-3/3	7,420	4.54	10.67	43	1,003	6	368	2
La Coima	11A 3/2-3/3	6,124	4.13	7.30	57	1,629	15	974	9
Muddingstone Diversion°	11:30A 3/2- 3/3	4,110	4.17	9.07	46	765	9	383	4
San Dimas	8A 3/2-3/3	3,395	4.00	9.31	43	581	7	273	3
Santa Anita	8A 3/2-3/3	3,404	5.90	11.99	49	723	10	393	6
Anton	7A 3/2-3/3	1,587	3.14	10.56	30	328	6	210	4
Big Dalton	8A 3/2-3/3	886	3.70	8.81	42	186	9	111	5
Thompson	8A 3/2-3/3	574	2.75	7.33	38	134	9	63	4
Lawpit	8A 3/2-3/3	821	4.71	8.93	53	159	10	84	5
Pierra Madre	8:45A 3/2- 3/3	534	4.19	11.60	36	239	16	202	14
Live Oak	5A 3/2-3/3	306	2.49	7.59	33	56	6	19	2

° Data include values for controlled tributary areas.

TABLE XIV

SUMMARY OF DAM OPERATION DURING STORM OF MARCH 2, 1938

	1	2	3	4	5	6	7	8	9	10
DAM	A. F. Storage at Spillway	% of Stor. Available at Beginn- ing of Max. 24 Hour Runoff	Max. 24 Hr. Runoff in A. F.	Ratio of Max. 24 Hr. Run- off To Capacity of Res. at Spillway	3 Day run- off preced- ing Max. 24 Hr. Runoff in A. F.	Ratio of 3 Day Run- off To Capacity of Res. at Spillway	Peak Inflow C.F.S.	Peak Outfl. C.F.S.	% Reduc- tion	Delay Between Pk. Infl. & Peak Outfl.
San Gabriel #1	53,700.	56.2	74830.	1.4	21547.	0.4	94380	57150	29.4	195 Min.
Tujunga No. 1	6240.	14.3	24870.	4.0	4210.	0.7	34000	32520	4.4	25 Min.
San Gabriel #2	12298.	13.7	16010.	1.3	5630.	0.5	23800	22180	6.8	15 Min.
Puddingstone	17398.	69.1	4680.	0.3	1690.	0.1	5850	0	100.0	-
Devil's Gate	3996.	33.9	7420.	1.9	2200.	0.6	11400	7060	38.1	210 Min.
Pacolma	5592.	42.1	6120.	1.1	1480.	0.3	8150	2470	69.7	8 Hrs. 45 Min.
Puddingstone $\star$ Diversion	121.	38.2	3910.	32.3	950.	7.9	5550	5490	1.1	5 Min.
San Dimas	1426	36.7	3400.	2.4	1060.	0.7	4400	4280	2.8	0
Santa Anita	1014.	46.3	3400.	3.4	1780.	1.8	4600	4500	2.2	10 Min.
Eaton	940.	51.7	1590.	1.7	560.	0.6	2225	2190	1.5	15 Min.
Big Dalton	1053.	53.3	890.	0.8	400.	0.4	1300	725	44.2	165 Min.
Thompson Creek	812.	80.3	570.	0.7	140.	0.2	600	120	79.7	22 Hrs.
Sawpit	389.	72.6	820.	2.1	300.	0.8	1120	680	29.3	105 Min.
Sierra Madre $\star$	47.	65.5	530.	11.4	340.	7.2	700	690	1.7	0
Live Oak	243.	70.7	310	1.3	100.	0.4	355	200	43.7	105 Min.

$\star$ Puddingstone Div. Dam is used for Diversion of flow only. Sierra Madre Dam is a debris retarding reservoir.

TABLE XV

DATA ON SILTATION OF RESERVOIRS
FROM DATE OF MOST RECENT SURVEY TO APRIL, 1938

Reservoir	Spillway Elevation	Date of Last Survey	Capacity at Spill. Elev. last Survey Ac. Ft.	Capacity at Spill. Elev. Apr. 1938 Ac. Ft.	Loss in Capacity to Spillway Elev. since last sur- vey Ac. Ft.	Percent of Capacity at Spill. Elev. Lost since Last Survey
Pacoima	1950.0	Jan. 1936	5592	5092	500	8.9
Big Tujunga	2290.0	1928	6240	4720	1520	24.4
Devil's Gate	1054.1	Nov. 1934	3996	3012	984	24.6
Eaton Wash	887.4	Nov. 1937	940	695	245	26.1
Sierra Madre	1172.5	1932	47	8	39	83.0
Big Santa Anita	1316.0	Feb. 1936	1014	687	327	32.2
Sawpit	1360.0	July 1936	389	320	69	17.7
San Gabriel Dam #1	1453.0	Extrapolation of 1937-1938	53700	48498	5202	9.7
San Gabriel Dam #2	2385.0	Jan. 1936	12298	10802	1496	12.2
Big Dalton	1706.0	Nov. 1934	1053	964	89	8.4
San Dimas	1463.4	Nov. 1935	1426	1166	260	18.2
Puddingstone Diver.	1152.5	June 1936	121	43	78	64.5
Live Oak	1497.0	Mar. 1936	243	226	17	7.0
Thompson Creek	1640.0	1932	812	786	26	3.2
Sunset Canyon	1603.7	Survey 1929 corr. to 1938 before storm	5	2	3	60.0
Totals and Average			87876	77021	10855	12.4

DATA ON SILTATION OF RESERVOIRS
SINCE CONSTRUCTION OF DAMS WAS COMPLETED

TABLE XVI

Reservoir	Date of Completion of Dam	Original Capacity at Spill. Elev. Ac. Ft.	Capacity at Spill. Elev. April, 1938 Ac.Ft.	Loss in Cap. to Spill. Elev. to April, 1938 Ac. Ft.	Per cent of Original Capacity at Spill.Elev. Lost to April, 1938
Pacoima	Feb. 1929	6060	5092	968	16.0
Big Tujunga	July 1931	6240	4720	1520	24.4
Devil's Gate	June 1920	4608	3012	° 1596	34.6
Eaton Wash	Feb. 1937	940	695	245	26.1
Sierra Madre	Feb. 1928	49	8	41	83.7
Big Santa Anita	Mar. 1927	1376	687	689	50.1
Sawpit	June 1927	476	320	156	32.8
San Gabriel Dam #1	July 1937	53700	48498	5202	9.7
San Gabriel Dam #2	Apr. 1934	12298	10802	1496	12.2
Big Dalton	Aug. 1929	1290	964	326	25.3
San Dimas	Sept. 1922	1495	1166	329	22.0
Puddingstone Diver.	July 1928	147	43	104	70.7
Live Oak	Nov. 1922	250	226	24	9.6
Thompson Creek	Mar. 1928	812	786	26	3.2
Sunset Canyon	Nov. 1929	6	2	°° 4	66.7
Totals and Average		89747	77021	12726	14.2

- ° Gravel sales by City of Pasadena removed 47 ac.ft. between 1920-1935
 °° F.C.Dist. removed 2.6 ac.ft. in de-silting reservoir since 1929

DATA ON ESTIMATED TOTAL DEBRIS MOVEMENT
FROM DATE OF LAST SURVEY TO APRIL, 1938

TABLE XVII

Reservoir	Ac.Ft. of Debris Deposited in Reser- voir below Spill Elev.	Est.Ac.Ft.of Debris de- posited in Reservoir and Channel above Spill. Elev. (Potential Siltation Debris)	Total Est. Ac.Ft. of Debris Moved by Flood which affects or May affect Spill. Capacity	Area of Watershed (Uncon- trolled) Sq.Mi.	Total Est. Debris Movement in Cu.Yds. per Sq.Mi. Area	Max.24 Hr. Inflow During Flood Ac.Ft.	Percent of Vol. Debris Moved to Vol. of Max. 24 Hr. Inflow
Pacoima	500	6	506	27.77	29,000	6,124	8.3
Big Tujunga	1,520	98	1,618	81.35	32,000	24,872	6.5
Devil's Gate	984	335	1,319	30.62	70,000	7,420	17.8
Eaton Wash	245	241	486	9.48	83,000	1,587	30.6
Sierra Madre	39	1	40	2.39	27,000	534	7.5
Big Santa Anita	327	110	437	10.82	65,000	3,404	12.8
Sawpit	69	11	80	3.27	39,000	821	9.7
San Gabriel Dam No. 1	5,202	° 799	6,001	161.55	60,000	74,832	8.0
San Gabriel Dam No. 2	1,496	° 92	1,588	40.42	63,000	16,012	9.9
Big Dalton	89	4	93	4.49	33,000	886	10.5
San Dimas	260	25	285	15.92	29,000	3,395	8.4
Puddingstone Diversion	78	45	123	2.57	77,000	4,110	3.0
Live Oak	17	2	19	2.30	13,000	306	6.2
Thompson Creek	26	4	30	3.91	12,000	574	5.2
Sunset Canyon	3	1	4	0.44	15,000	-	-
Totals and Average	10,855	1,774	12,629	397.30	51,000	144,877°°	8.7°°

° Does not include potential siltation debris in channel.

Includes debris to Elev. 2400 in S.G.#2; to Elev. 1481 in S.G.#1.

°° Does not include flow from Sunset Canyon Dam which is unknown.

DATA ON DEBRIS DEPOSITED IN DEBRIS BASINS
FROM FEBRUARY 28 TO MARCH 3, 1938

TABLE XVIII

Debris Basin	Design Debris Capacity Cu.Yds.	Vol.Debris in Basin March 3 Cu.Yds.	Est.Vol. Debris in Basin Prior to Feb. 28 Cu.Yds.	Est.Vol.Debris Deposited in Basin from Feb. 28 to March 3 Cu.Yds.	Area of Watershed Sq.Mi.	Rate of Erosion Feb.28 to Mar.3 in Cu.Yds. per Sq.Mi. of Watershed
Haines	158,200	51,500	None	51,500	1.53	34,000
Dunsmuir °	128,200	78,500	20,000	58,500	.84	70,000
Shields °	45,500	33,500	1,000	32,500	.27	120,000
Eagle-Goss	71,900	41,700	1,000	40,700	.61	67,000
Pickens °	112,700	°°162,200	12,000	150,200	1.84	82,000
Hall-Beckley °	91,800	°°°103,600	10,000	93,600	.84	111,000
Snover	34,800	17,900	1,000	16,900	.23	73,000
Hay	37,800	13,600	1,000	12,600	.20	63,000
Verdugo °	105,700	♢ 100,000	15,000	85,000	-	-
Lincoln °	23,500	♢ 18,000	1,000	17,000	.50	34,000
Fern	21,100	21,200	500	20,700	.30	69,000
West Ravine	44,900	29,900	500	29,400	.25	118,000
Fair Oaks	20,200	12,400	500	11,900	.21	57,000
Las Flores °	36,400	38,500	1,000	37,500	.42	89,000
Brand	69,500	♢ 15,000	2,000	13,000	1.03	13,000
Nichols	32,200	♢ 21,000	3,000	18,000	.94	19,000
Totals	1,034,400	758,500	69,500	689,000	♢♢ 10.01	♢♢ 60,000

° Some debris passed over spillway.

°° Includes 40,000 cu.yds. estimated to have been deposited in Pickens Channel above inlet structure.

°°° Includes 4,000 cu.yds. estimated to have been deposited in Hall-Beckley channel above inlet structure.

♢ Estimated volumes.

♢♢ Does not include Verdugo Watershed which is partially controlled by several of the Debris Basins.

